Transmission Expansion Advisory Committee

May 12, 2010

Issues Tracking

- Issues requested at April PC/TEAC meeting
- Responses received
  - Administrative questions (TEAC meeting minutes)
  - Local planning discussion
  - Cost allocation (post projected cost allocations to the web)
- Issues tracking related to outstanding analytic questions / needs

Owner	Requestor	Issue Identifier	Issue Title	Issue Description	Issue Status	Stakeholder Body	Date Created

2010 RTEP Sensitivity Analysis Methodology

Sensitivity Study Focus

- Analysis will focus on EHV facilities
- Studies will focus on long term impact

15 Year Calculations (existing method)

- Yearly Load Increase (MW) for each PJM Zone
  - Difference in Yearly Load Forecasts for each PJM Zone
- Area Load DFAX (p.u.) for each PJM Zone
  - Source = all PJM generation
  - Sink = load in each PJM zone
- Existing Demand Response and Energy Efficiency
  - Reflected in the Yearly Load Increase

15 Year Calculations (existing method)

- 15 Year Load (MW) Calculation including existing DR & EE
  - Calculated for years 6 through 15 for each PJM zone

15 Year Calculations (existing method)

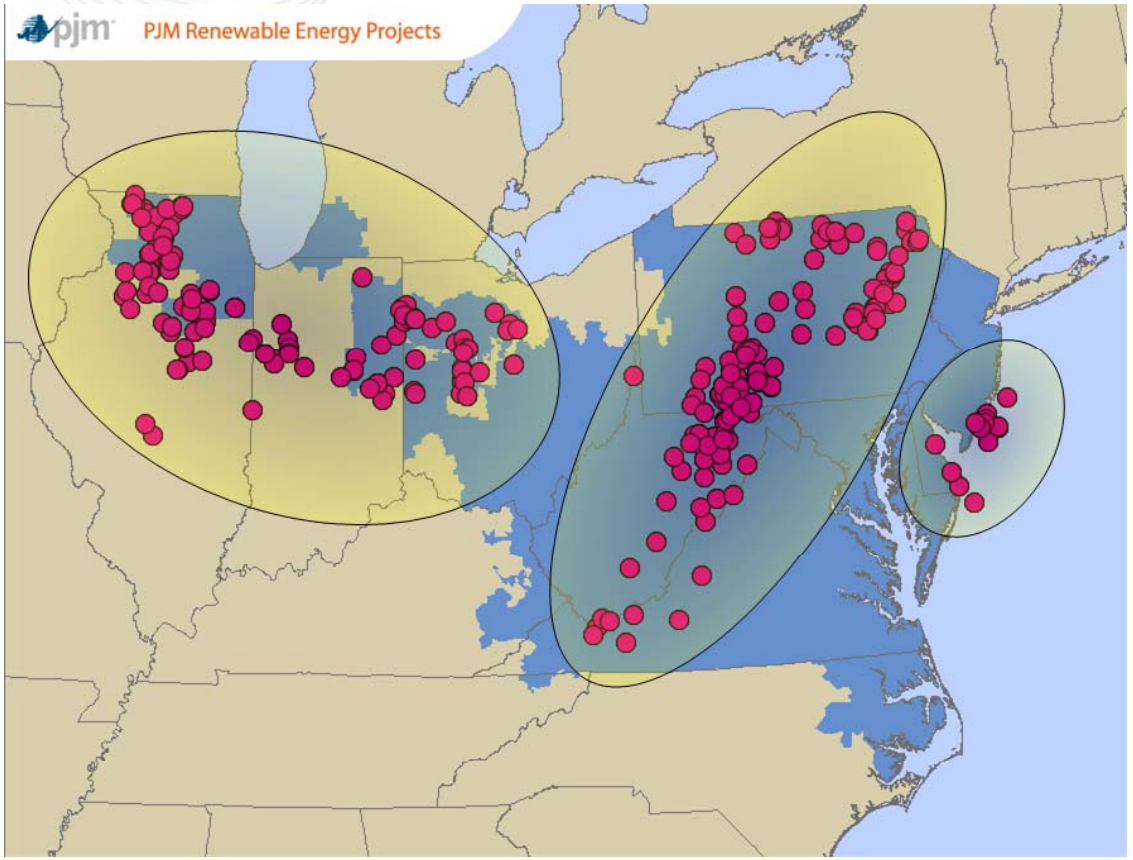
- 15 Year Loading Multiplier
  - Calculated for years 6 through 15 for every facility
  - Scales the loading to include the impact of supplying additional load in a future year

15 Year Calculations (existing method)

- Final 15 Year Loading (%)
  - 15 year loading (MW) / Facility Rating
  - Calculated for years 6 through 15 for every facility

15 Year Calculations (Sensitivity Analysis Method)

- Source used for Sensitivity Scenario DFAX calculation
  - Three zones
    - Atlantic Offshore
    - Appalachian Mountans
    - Western
  - Buses selected from each zone for use in DFAX calculation
  - Participation factor for each zone calculated using existing interconnection queue data

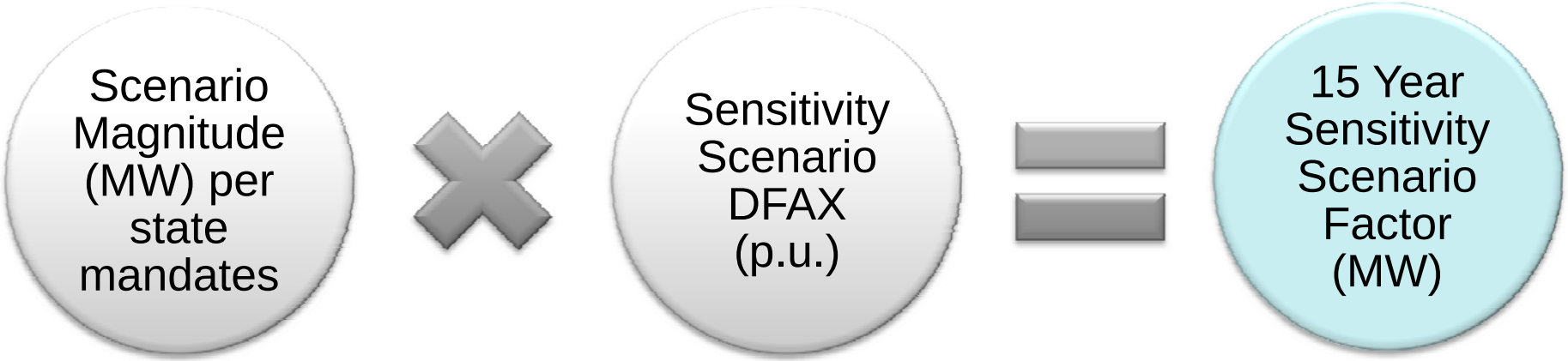


15 Year Calculations (Sensitivity Analysis Method)

- Sink used for Sensitivity Scenario DFAX calculation
  - Scenario Dependant
    - Assume existing PJM generation remains
      - Sink = all PJM generation
    - Assume at-risk generation is displaced
      - Sink = at-risk generation
  - At-risk generation
    - Generation that has not cleared in recent RPM auctions
    - Generation in a carbon constrained world
    - Revenue adequacy at risk generation
      - MMU SOM report identified 11,250 MW of generation
    - Aging Generation

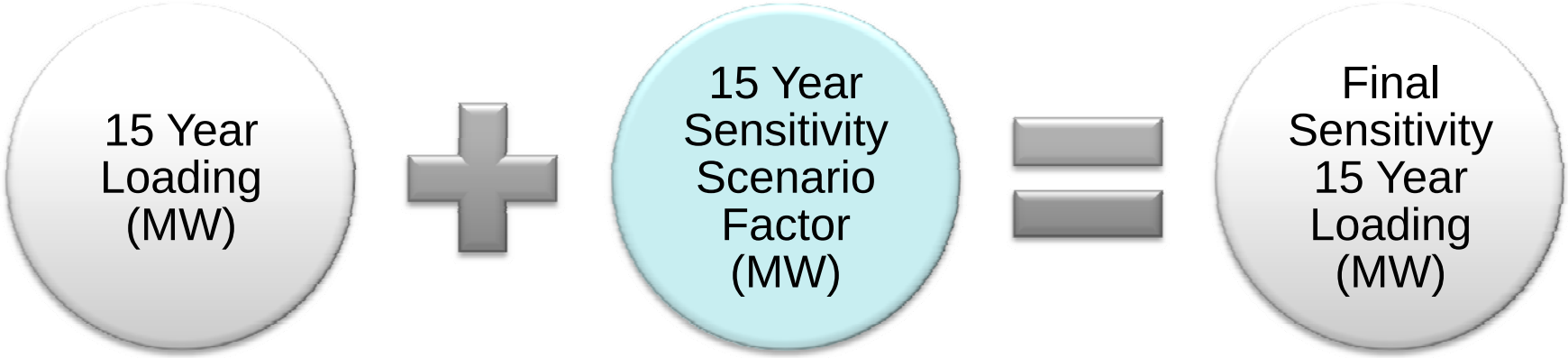
15 Year Calculations (Sensitivity Analysis Method)

- 15 Year Sensitivity Scenario Factor
  - Calculated for years 6 through 15 for each PJM zone
  - DFAX calculated by sourcing wind generation and sinking to at-risk generation
  - Sensitivity scenario magnitude calculated using state RPS requirements



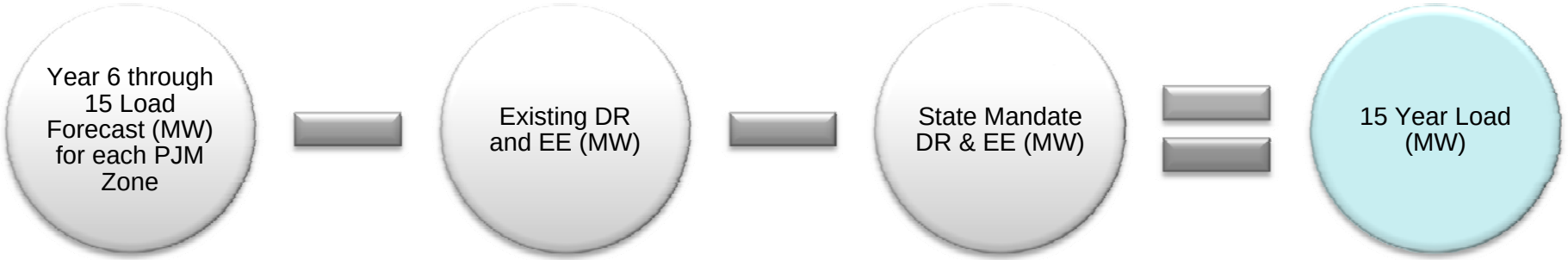
15 Year Load Level Calculation (Sensitivity Analysis Method)

- Final Sensitivity 15 Year Loading (%)
  - Final loading (MW) / Facility Rating
  - Calculated for years 6 through 15 for every facility



15 Year Load Level Calculation (Sensitivity Analysis Method)

- 15 Year Load (MW) including existing DR & EE and state DR & EE mandates
  - Calculated for years 6 through 15 for each PJM zone



Analysis Scenarios

1. Add renewable generation to meet RPS assuming existing PJM generation remains

2. Add renewable generation to meet RPS assuming RPS displaces at-risk generation

3. Add renewable generation to meet RPS + DR + EE mandates assuming RPS displaces at-risk generation

Scenario	Sensitivity	Source	Sink	Test
RPS Sensitivity 1	RPS	Renewable Generation	Existing PJM Generation	Generator Deliverability & Load Deliverability
RPS Sensitivity 2	RPS	Renewable Generation	At-Risk Generation	
RPS Sensitivity 3	RPS + DR + EE	Renewable Generation	At-Risk Generation	

Eddystone & Cromby Retirement Study Update*

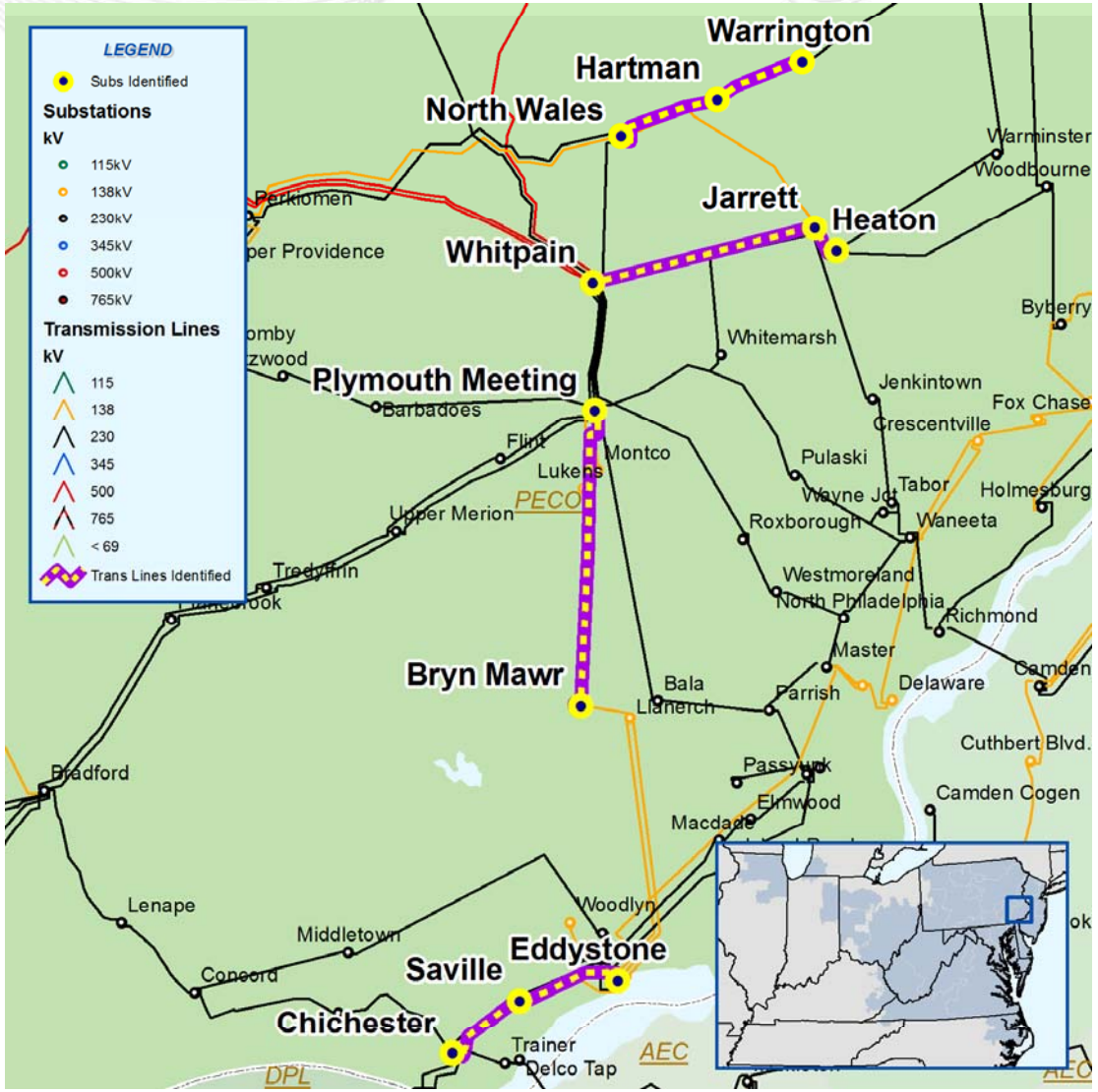
* Indicates updated information since March 2010 TEAC Meeting

Proposed Generation Retirement

- In December 2009 Exelon notified PJM of their intent to retire the Eddystone 1&2 units and the Cromby 1&2 units in the PECO Energy Transmission zone
- Proposed deactivation date is May 31, 2011
- PJM staff has been evaluating the impact of the proposed deactivation
- The following slides include the recommended upgrades and the expected in-service date

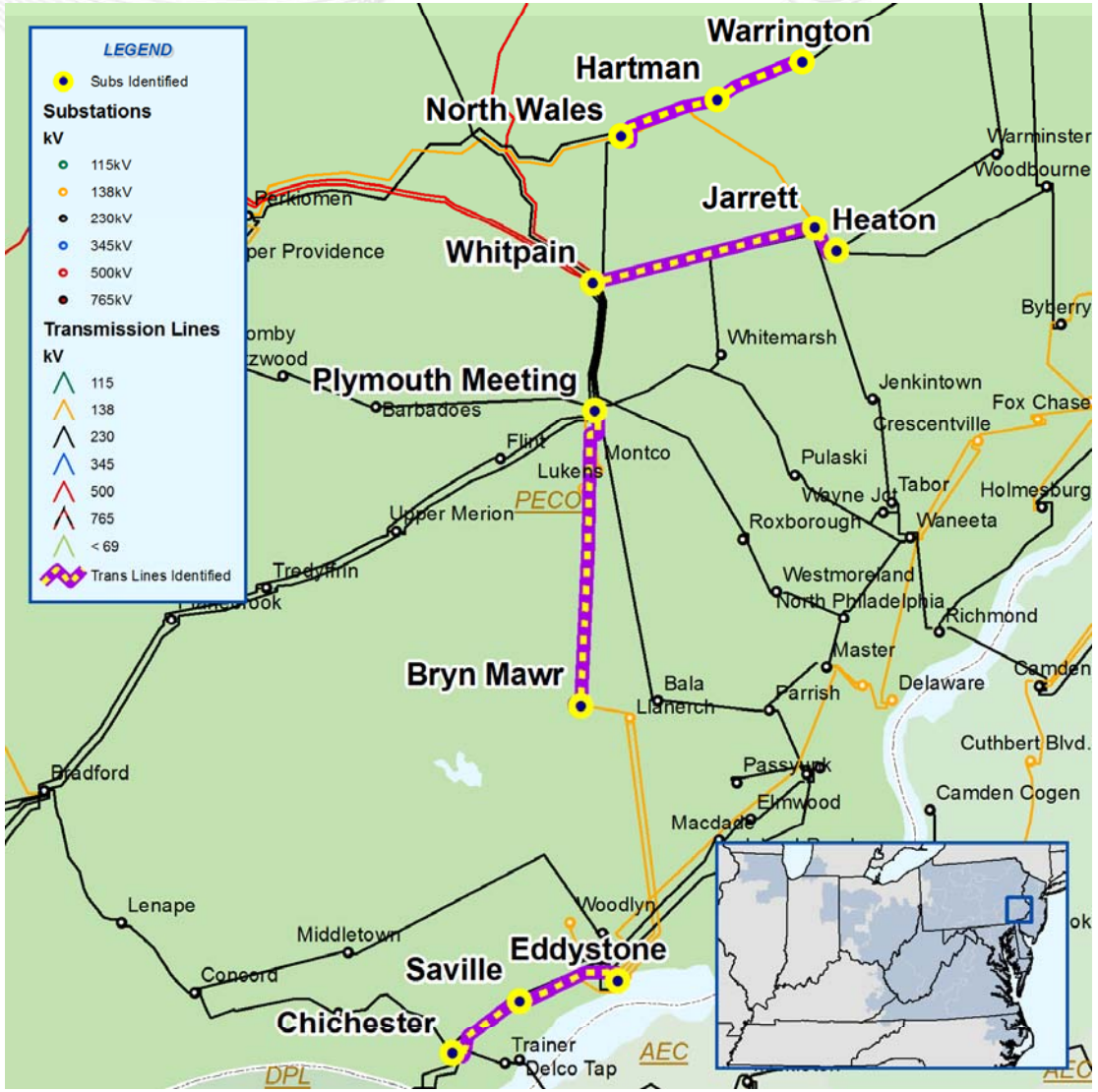
PECO Transmission Zone

- Chichester 230/138 kV transformer / loss of Macdade – Ridley – Morton 230 kV line (220-46) + loss of Island Road – Eddystone 230 kV line (220-23)
- Recommended Solution: Add a second 230 / 138 kV transformer at Chichester. Add an inductor in series with the parallel transformers
- Estimated cost: $5.908 M
- Expected In-service: December 16, 2011



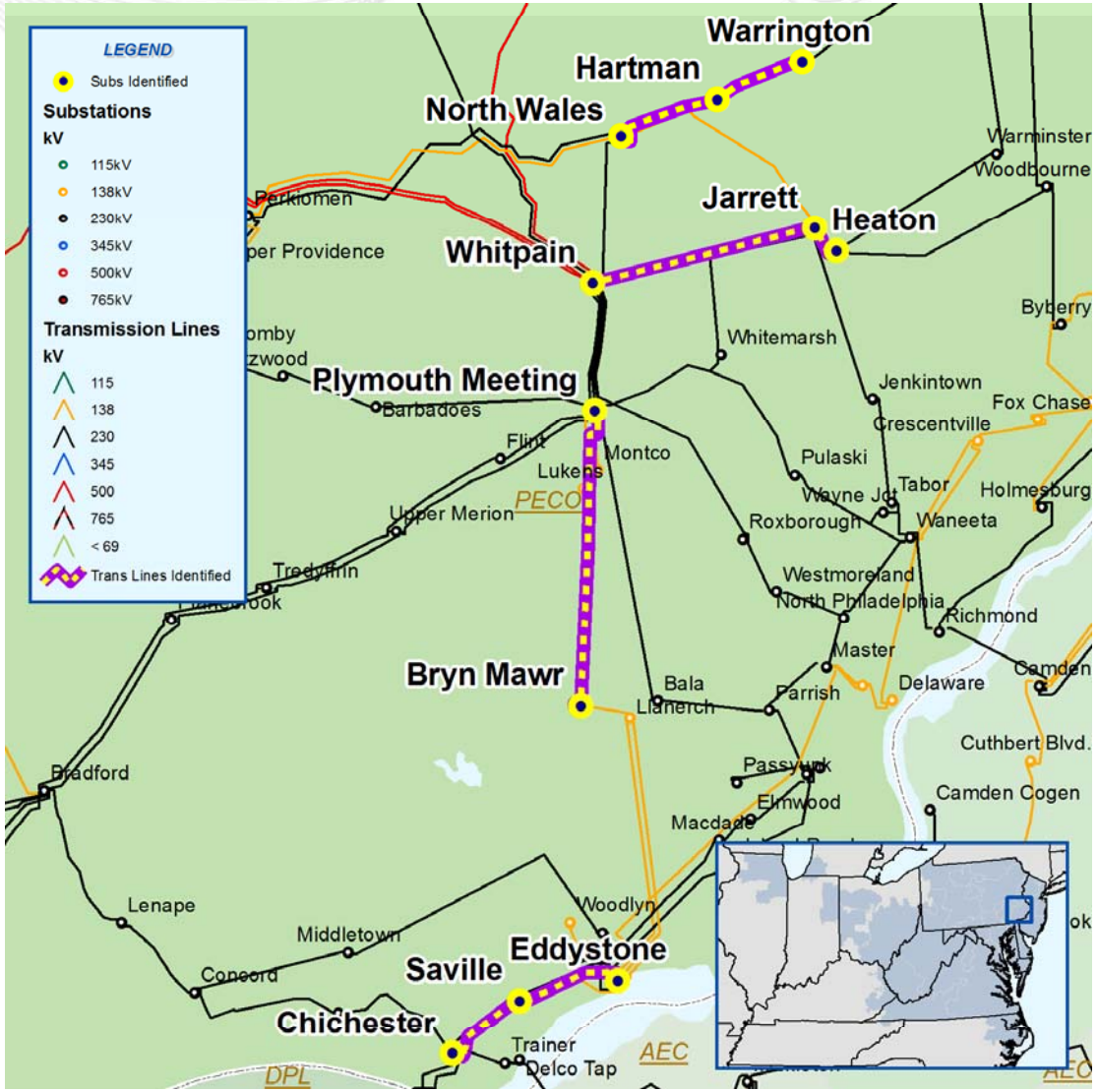
PECO Transmission Zone

- Eddystone – Saville 138 kV line / loss of Macdade – Ridley – Morton 230 kV line (220-46) + loss of Island Road – Eddystone 230 kV line (220-23)
- Recommended Solution: Replace terminal equipment at Eddystone and Saville and replace underground section of the line
- Estimated Cost: $3.94 M
- Projected In-Service: May 27, 2011



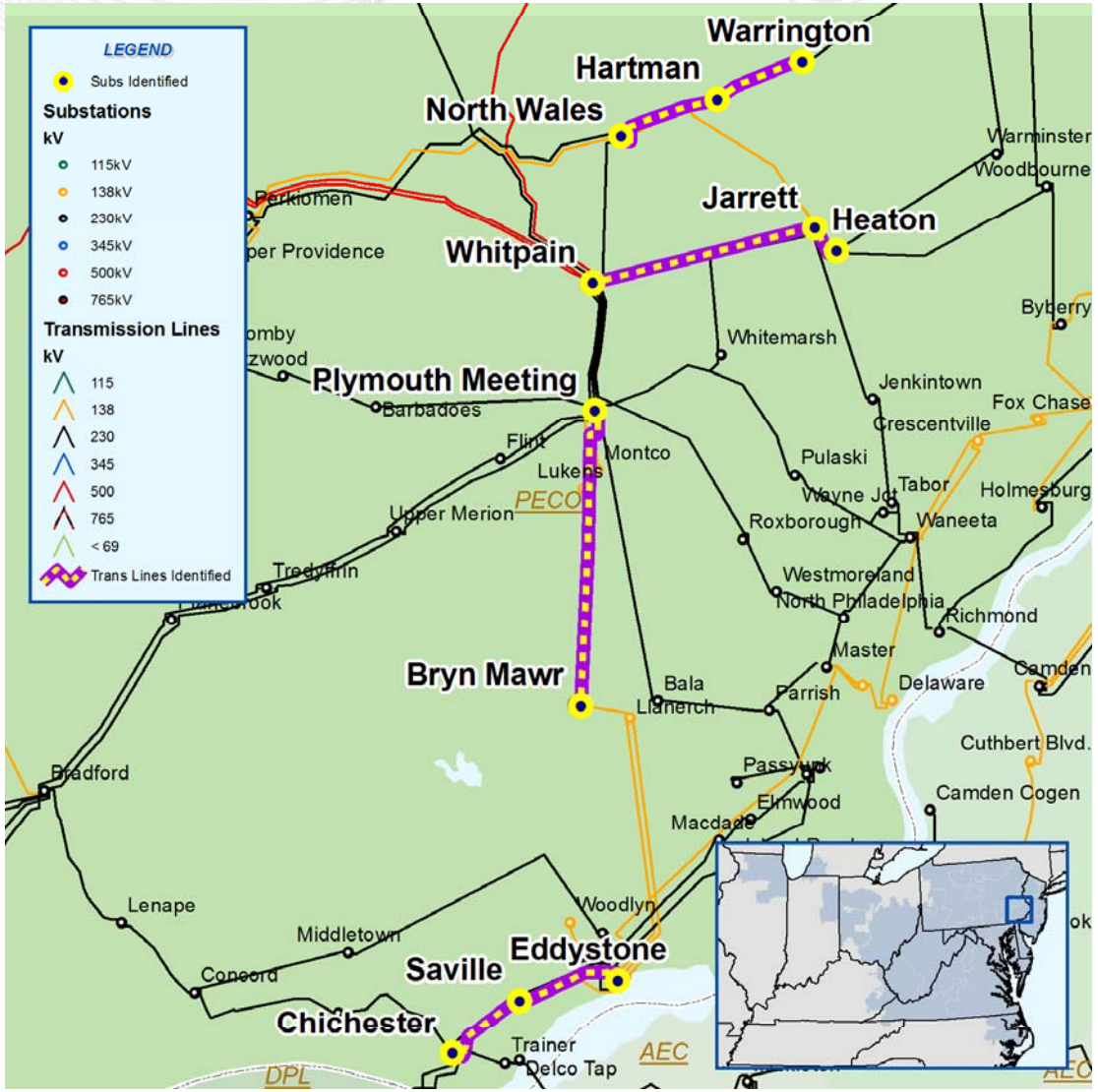
PECO Transmission Zone

- Jarrett – Whitpain 230 kV line / loss of North Wales – Hartman 230 kV line (220-71) + Basecase
- Recommended Solution: Replace terminal equipment at Whitpain and Jarrett
- Estimated Cost: $ 0.175 M
- Projected In-Service: May 27, 2011



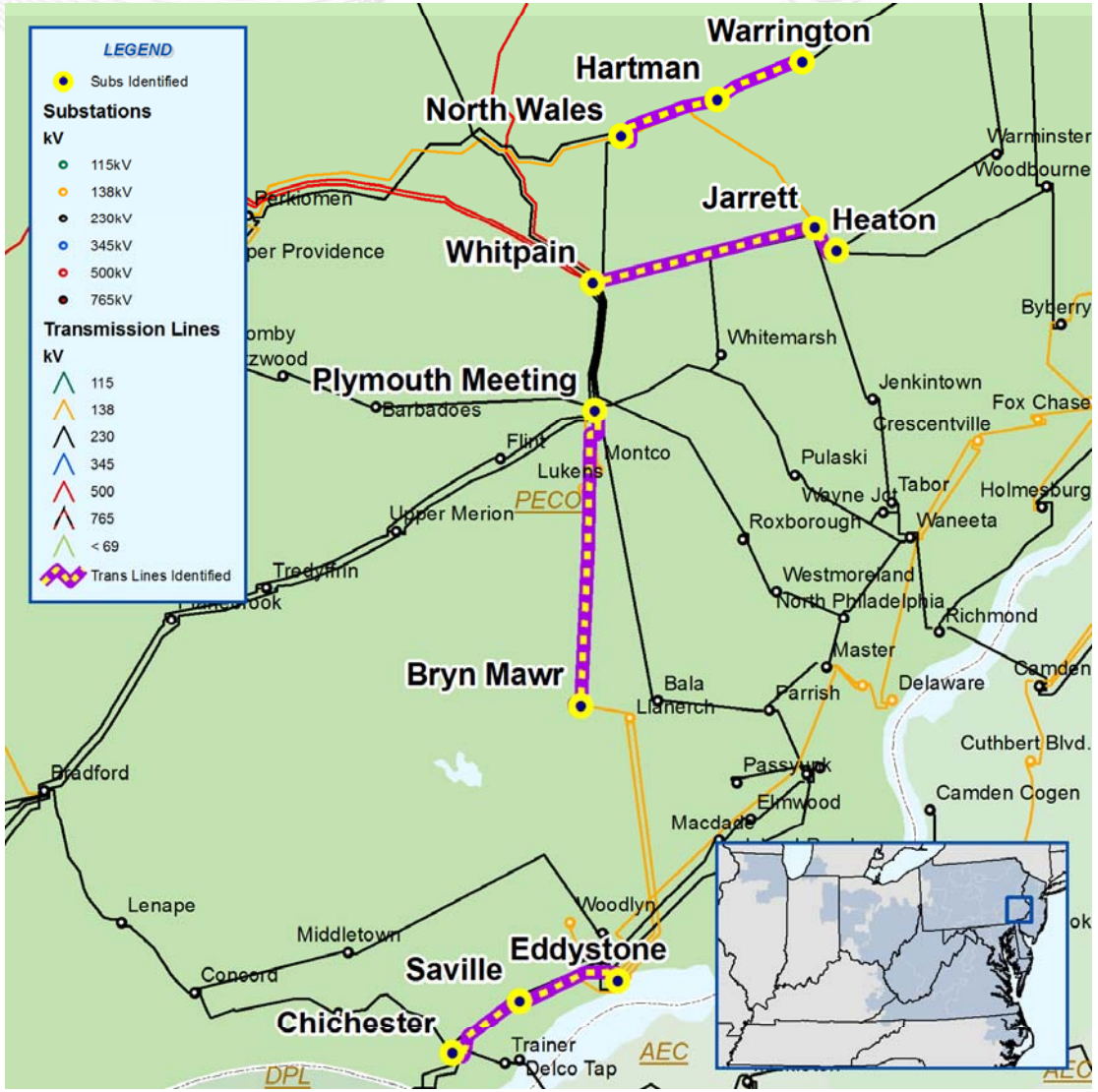
PECO Transmission Zone*

- Jarrett – Heaton 230 kV line / loss of North Wales – Hartman 230 kV line (220-71) + Basecase
- Recommended Solution: Replace terminal equipment at Heaton and Jarrett substations
- Estimated cost: $ 0.525 M
- Expected In-Service: May 27, 2011



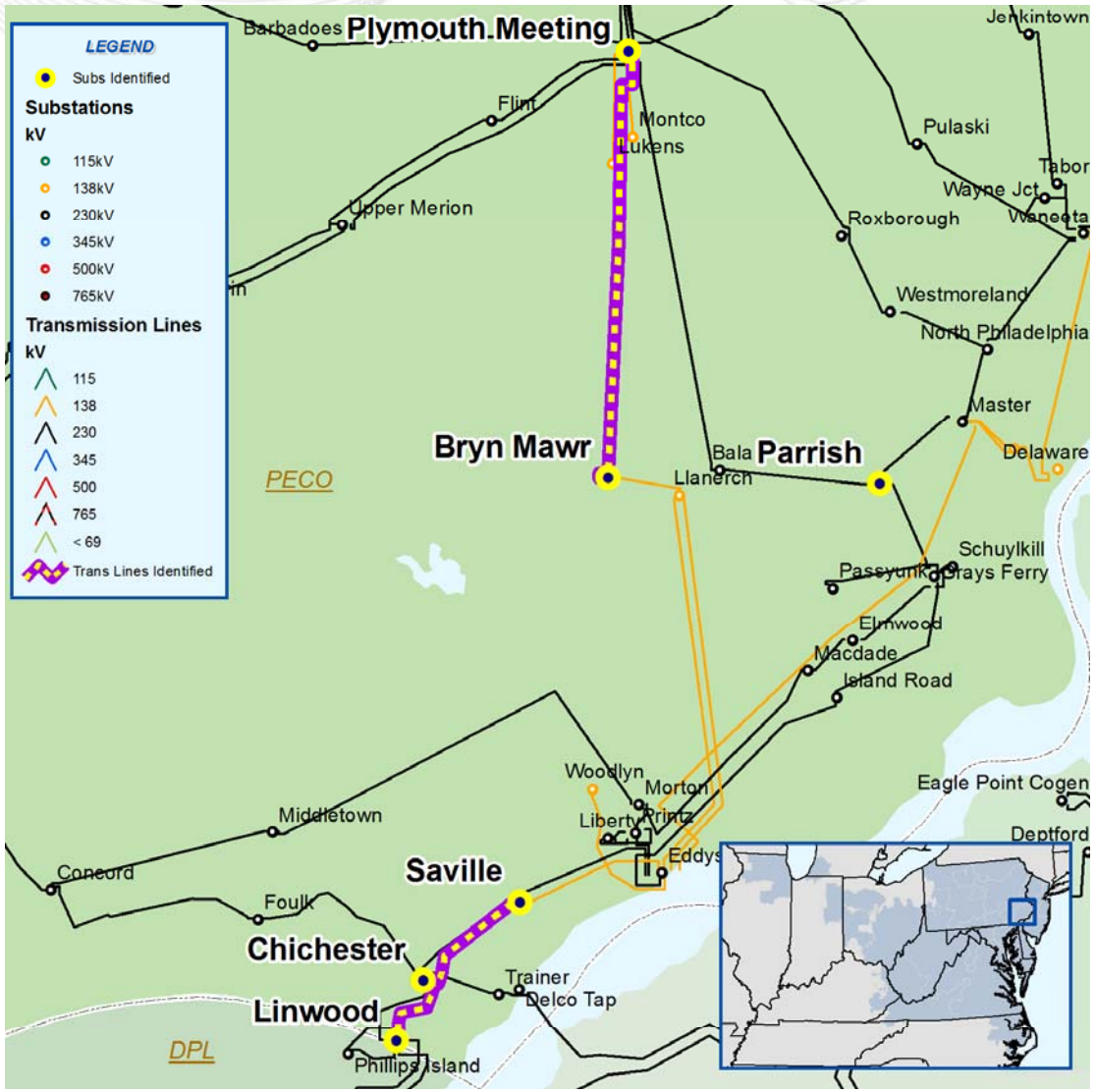
PECO Transmission Zone

- Hartman – Warrington 230 kV line overload for the following contingencies
  - loss of Emilie – Neshaminy 138 kV line (130-25) + loss of Jarrett – Whitpain 230 kV line (220-52)
  - loss of Jarrett – Whitpain 230 kV line (220-52) + Basecase
- Recommended Solution: Replace terminal equipment at Warrington and Hartman
- Estimated Cost: $ 0.375 M
- Projected In-Service: May 27, 2011



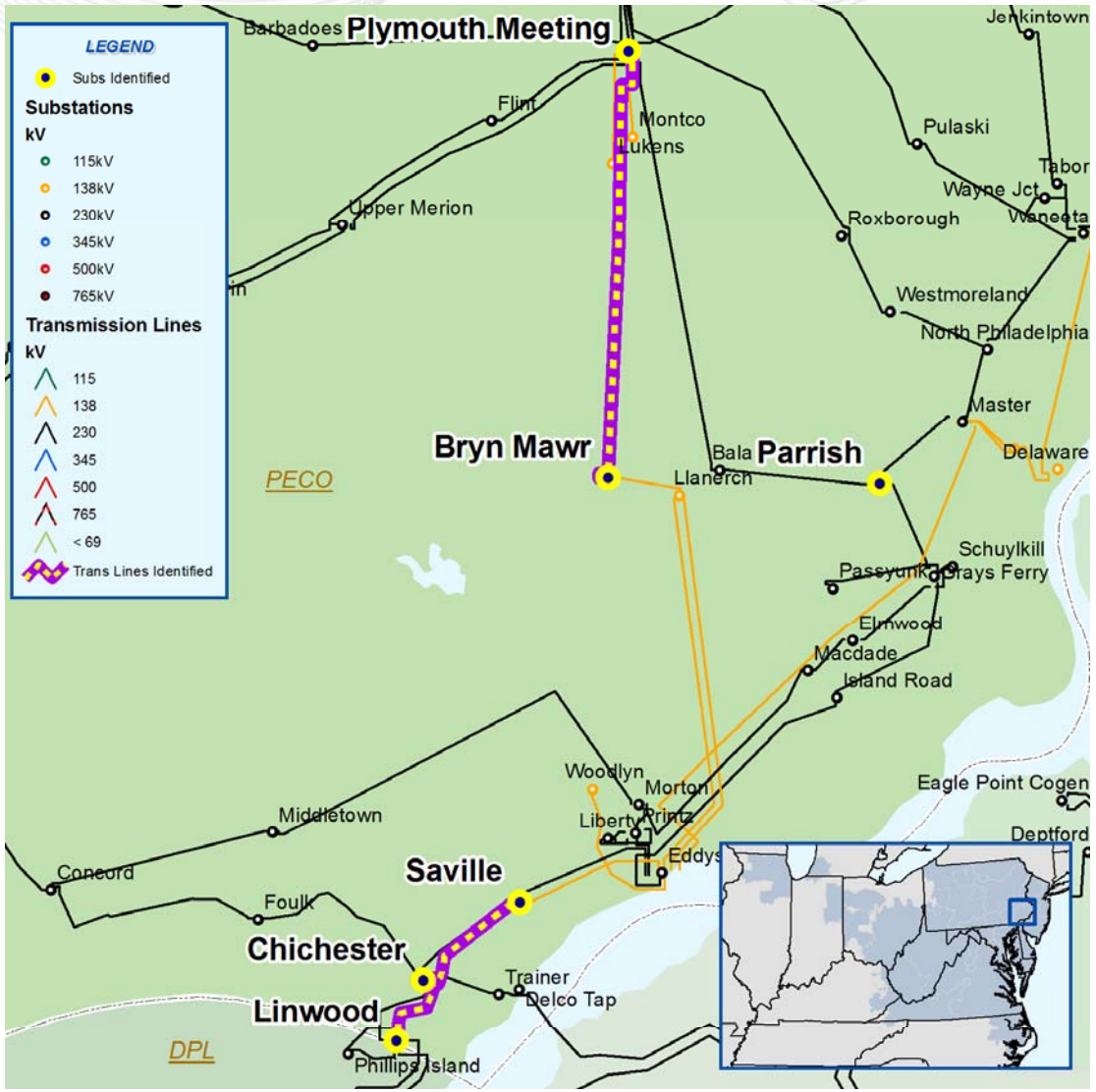
PECO Transmission Zone

- Linwood – Chichester ‘220-43’ 230 kV line / single contingency (‘220-39’) loss of Linwood – Chichester ‘220-39’ 230 kV line and Philips island generating units CT2, CT3, and ST
- Recommended Solution: Replace terminal equipment at Chichester
- Estimated Cost: $0.475 M
- Expected In-Service: May 27, 2011



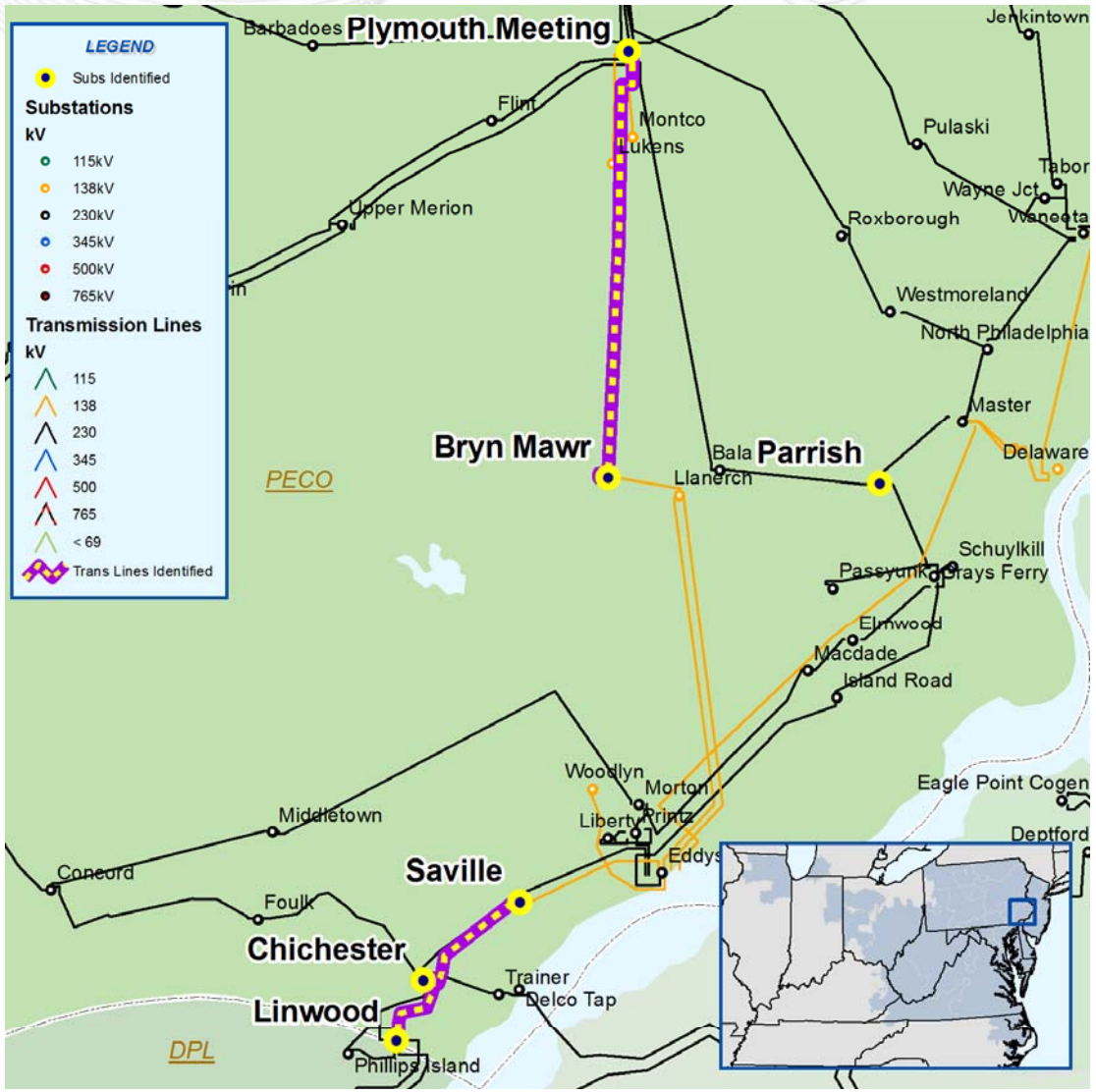
PECO Transmission Zone

- Linwood – Chichester ‘220-39’ 230 kV line / single contingency (‘220-43’) loss of Linwood – Chichester ‘220-43’ 230 kV line and Philips island generating units CT2, CT3, and ST
- Recommended Solution: Replace terminal equipment at Chichester
- Estimated Cost: $0.475 M
- Expected In-Service: May 27, 2011



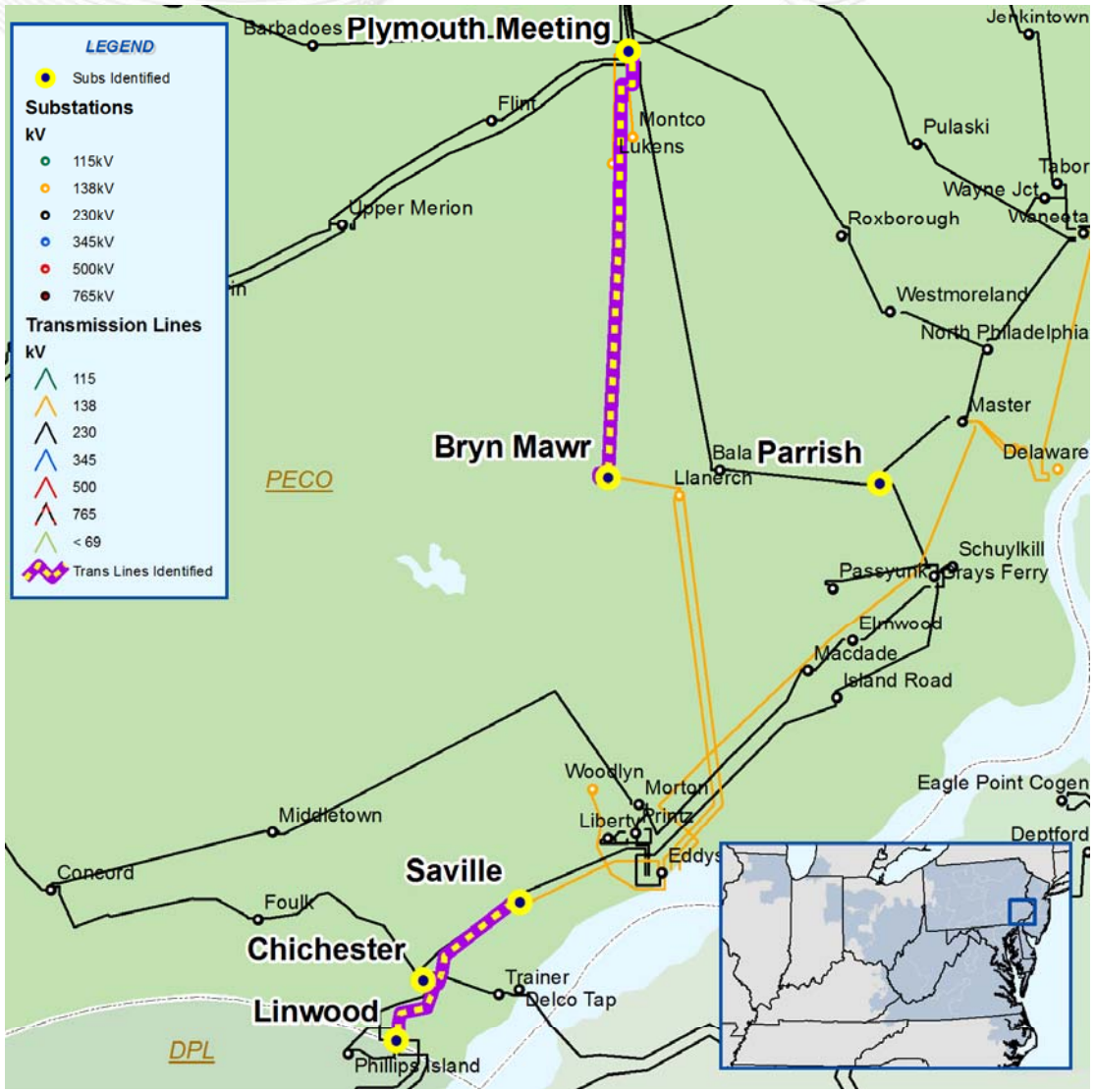
PECO Transmission Zone*

- Chichester – Saville 138 kV line overloaded for the following contingencies:
  - line fault with stuck breaker contingency ('GRAYS275') loss of Grays Ferry – Tunnel 230 kV line due to Grays Ferry stuck breaker '275'
  - bus contingency ('PLYM138B') loss of Plymouth Meeting 138 kV bus
  - single contingency ('220-27B') loss of Gays Ferry – Tunnel 230 kV line
  - Basecase for gen deliv test
  - loss of Macdade – Ridley – Morton 230 kV line (220-46) + loss of Island Road – Eddystone 230 kV line (220-23)
- Recommended Solution: Reconductor the line and upgrade terminal equipment
- Estimated cost: $ 8.5 M
- Expected in-service: December 31, 2012



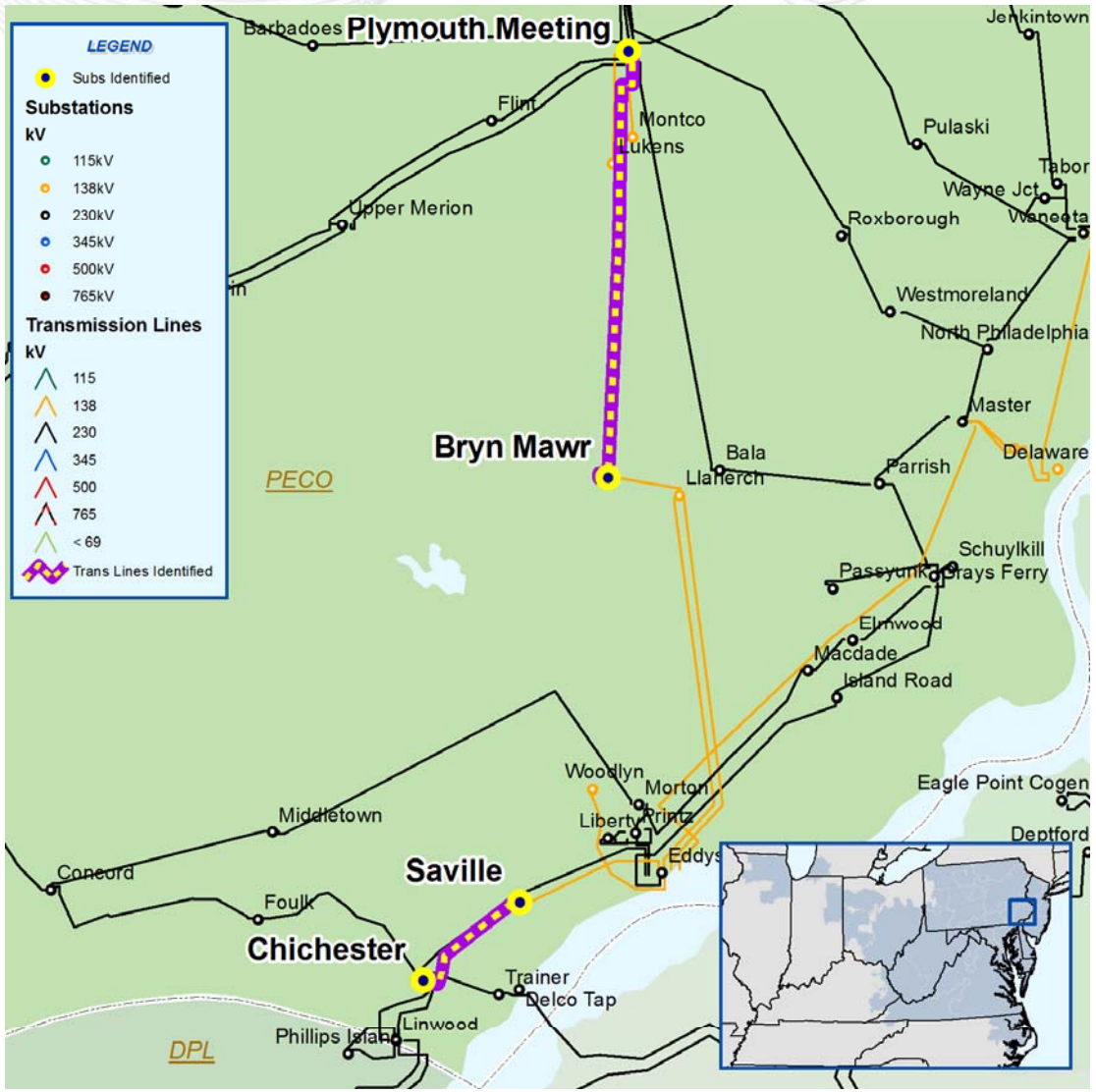
PECO Transmission Zone

- Tunnel – Parrish 230 kV line overloaded for the following contingencies
  - single contingency ('PJM89_A') loss of New Freedom – East Windsor 500 kV for gen deliv test
  - Basecase for gen deliv test
- Recommended Solution: Replace terminal equipment at Parrish
- Estimated Cost: $0.15 M
- Expected In-Service: May 27, 2011



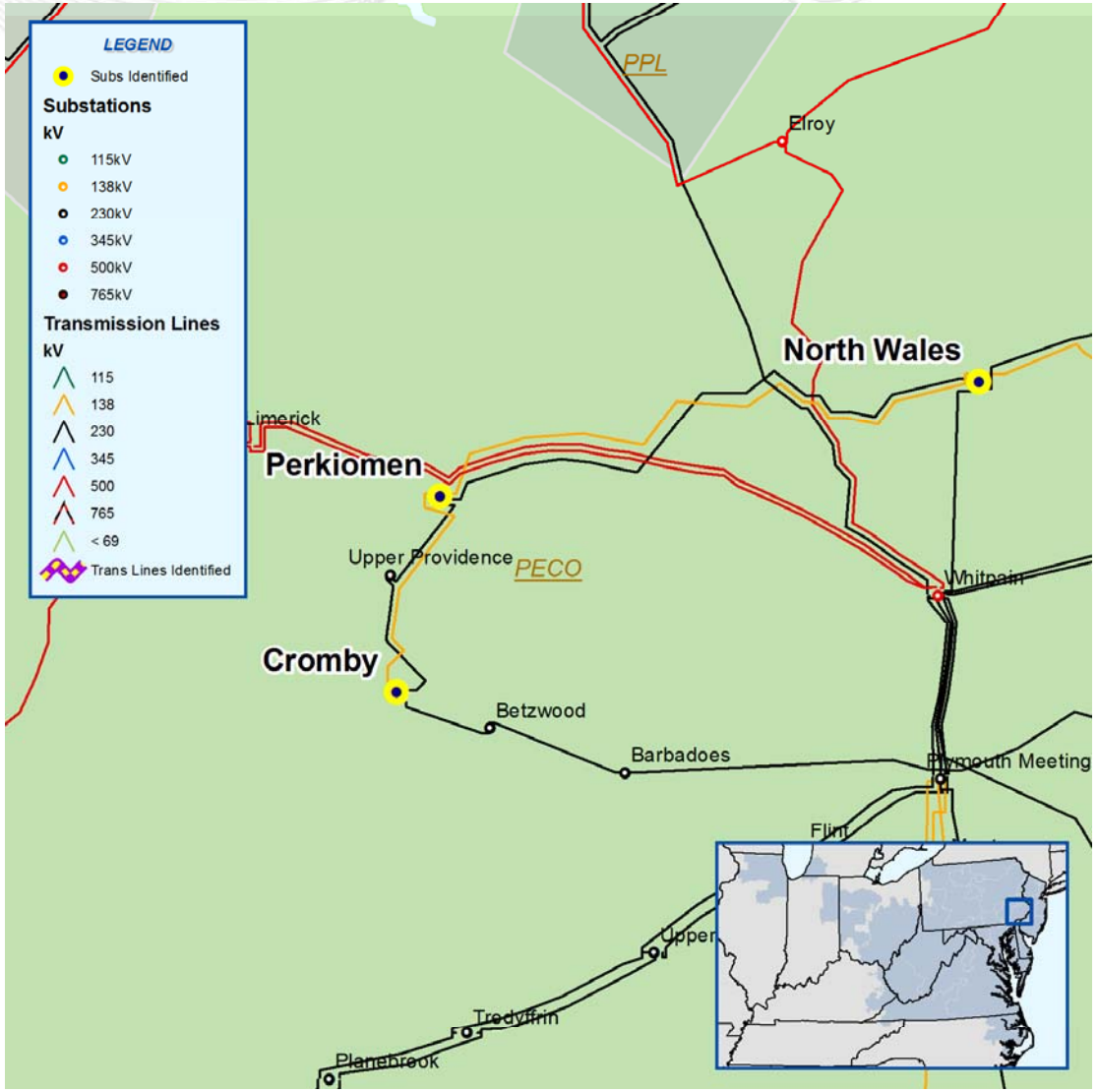
PECO Transmission Zone

- Plymouth Meeting – Bryn Mawr 138 kV line overload for the following contingencies:
  - bus contingency ('CHI230B1') loss of Chichester bus section 1
  - line fault with stuck breaker contingency ('CHICH045') loss of Chichester – Foulk 230 kV line and Foulk 230/13.8 kV transformer #2 as well as Chichester bus section 1 due to the Chichester stuck breaker '045'
  - loss of Chichester 230/138 kV transformer (CHICH-T9) + Basecase
  - loss of Chichester 230/138 kV transformer (CHICH-T9) + Eddystone – Master 138 kV line (130-43)
  - line fault with stuck breaker contingency ('CHICH785') loss of the Chichester 230/138 kV transformer and Chichester 138/69 kV transformer s #7 & 8
- Recommended solution: Install 230/138 kV transformer at Eddystone
- Estimated cost: $3.6 M
- Expected in-service: June 1, 2011



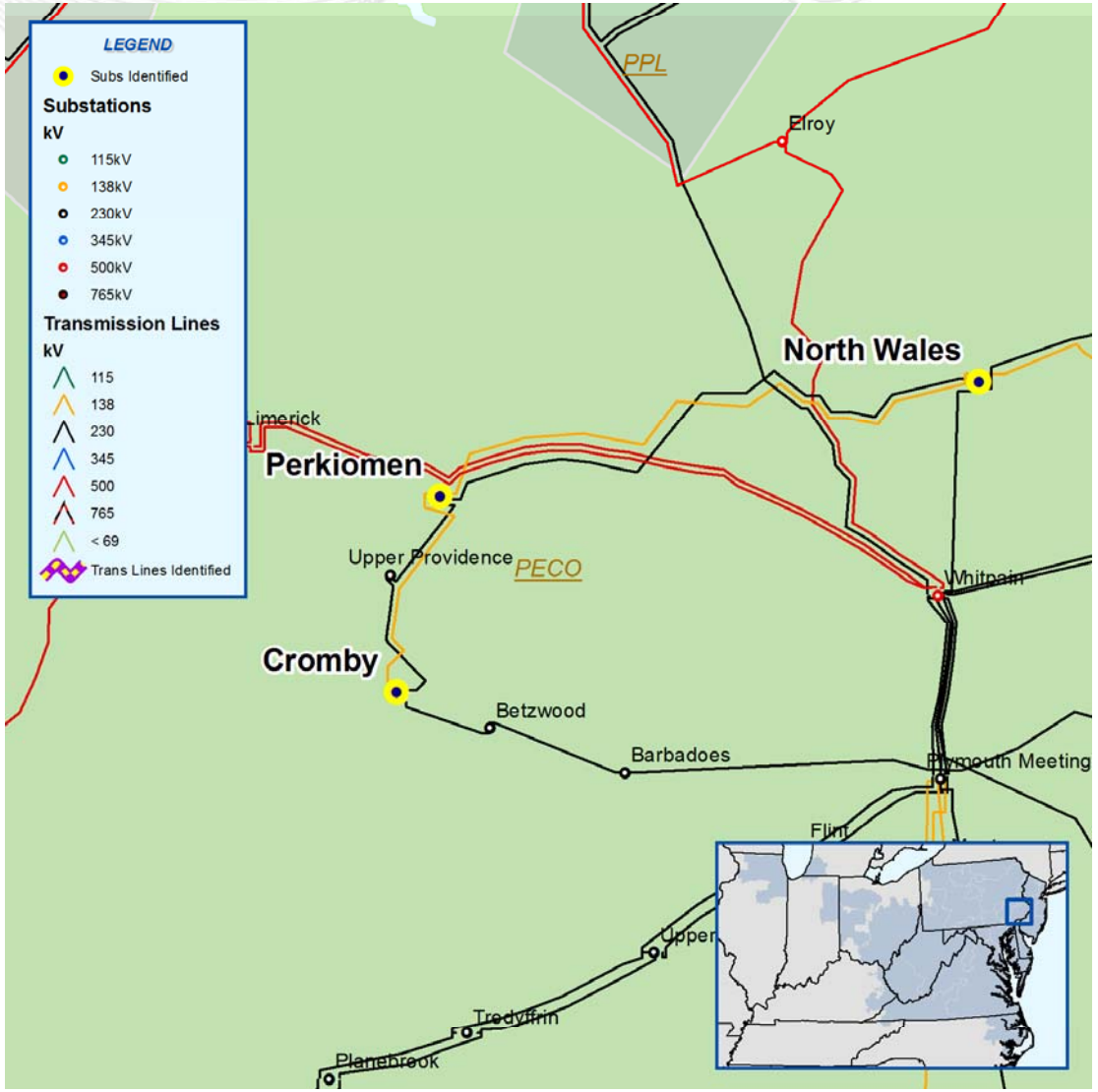
PECO Transmission Zone

- North Wales and Heaton 138 kV area low voltage violations for the following contingencies
  - bus contingency ('HEAT138B') loss of Heaton 138 kV station bus section 2
  - line fault with stuck breaker contingency ('HEAT0805') loss of Heaton – Woodbourne 230 kV line with stuck breaker 805
  - line fault with stuck breaker contingency ('HEAT0995') loss of Heaton – Woodbourne 230 kV line with stuck breaker 995
- Recommended Solution: Add a second 230/138 kV transformer at Heaton. Add a circuit breaker on the Heaton – North Wales 138 kV line. Add a 35 MVAR capacitor at Heaton
- Estimated cost: $7.754 M
- Expected in-service: December 16, 2011



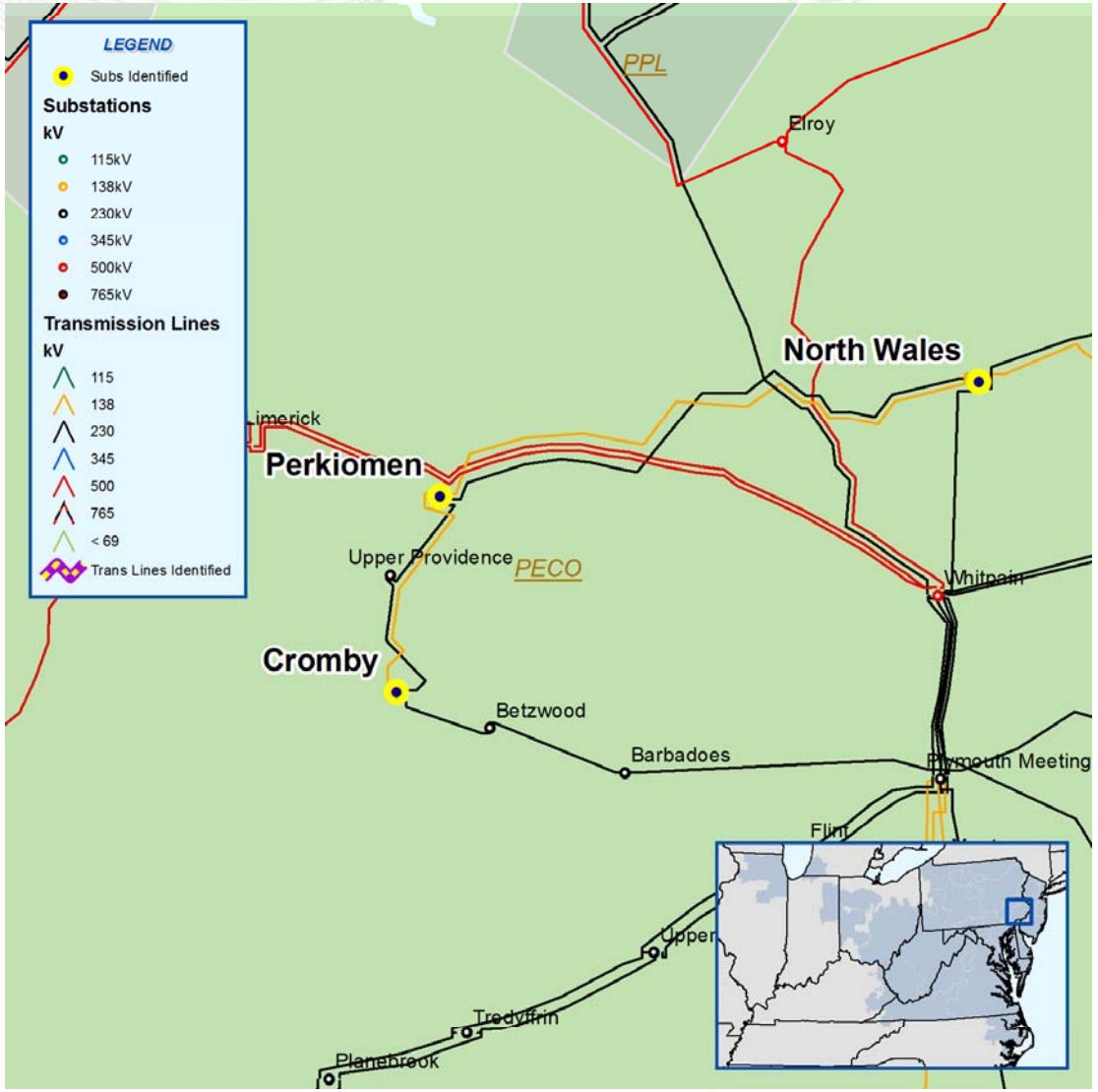
PECO Transmission Zone*

- Cromby 138 kV station low voltage violations for the following contingencies:
  - bus contingency ('HEAT138B') loss of Heaton 138 kV station bus section 2
  - line fault with stuck breaker contingency ('HEAT0805') loss of Heaton – Woodbourne 230 kV line with stuck breaker 805
  - line fault with stuck breaker contingency ('HEAT0995') loss of Heaton – Woodbourne 230 kV line with stuck breaker 995
- Recommended Solution: Replace 230/69 kV transformer #6 at Cromby. Add two 50 MVAR 230 kV capacitor banks at Cromby
- Estimated Cost: $ 6.142 M
- Projected in-service: December 31, 2011



PECO Transmission Zone

- Perkiomen 138 kV station voltage violations for the following contingencies:
  - bus contingency ('HEAT138B') loss of Heaton 138 kV station bus section 2
  - line fault with stuck breaker contingency ('HEAT0805') loss of Heaton – Woodbourne 230 kV line with stuck breaker 805
  - line fault with stuck breaker contingency ('HEAT0995') loss of Heaton – Woodbourne 230 kV line with stuck breaker 995
- Recommended Solution: Add 138 kV circuit breakers at Cromby, Perkiomen, and North Wales. Add a 35 MVAR 138 kV capacitor at Perkiomen
- Estimated Cost: $ 3.9 M
- Expected In-Service: August 1, 2011



- Eddystone 230 kV CB #365
  - Recommended solution: Upgrade the circuit breaker
  - Estimated Cost: $0.125 M
  - Expected In-Service: May 31, 2011

- Eddystone 230 kV CB #785
  - Recommended solution: Upgrade the circuit breaker
  - Estimated Cost: $0.125 M
  - Expected In-Service: May 31, 2011

- Eddystone 230 kV CB #35
  - Recommended solution: Upgrade / replace the circuit breaker
  - Estimated Cost: TBD
  - Expected In-Service: May 27, 2011
- Eddystone 230 kV CB #45
  - Recommended solution: Upgrade the circuit breaker
  - Estimated Cost: TBD
  - Expected In-Service: May 27, 2011
- Note: Both of these circuit breakers are Exelon Power circuit breakers

- As noted on the previous slides a number of upgrades are not expected to be placed in-service until after the requested deactivation date

- PJM notified Exelon Power that Cromby #2 is needed for reliability until December 31, 2011 and Eddystone #2 is needed for reliability until December 31, 2012

Baseline Reliability Update – Potential Reliability Violations

2015 Study Status

- 2015 Load Deliverability Voltage and Load Deliverability Thermal Testing
  - Several areas have passed with no Potential reliability violations
    - AEP
    - Atlantic Electric
    - DPL
    - DPL South
    - Duquesne
    - Meted
    - Penelec
    - PECO
    - PPL
    - WMAAC
- 2015 Generator Deliverability and 2015 N-1-1 Thermal underway for all areas
- 2015 N-1-1 thermal is in-progress. Voltage will begin following the thermal testing.

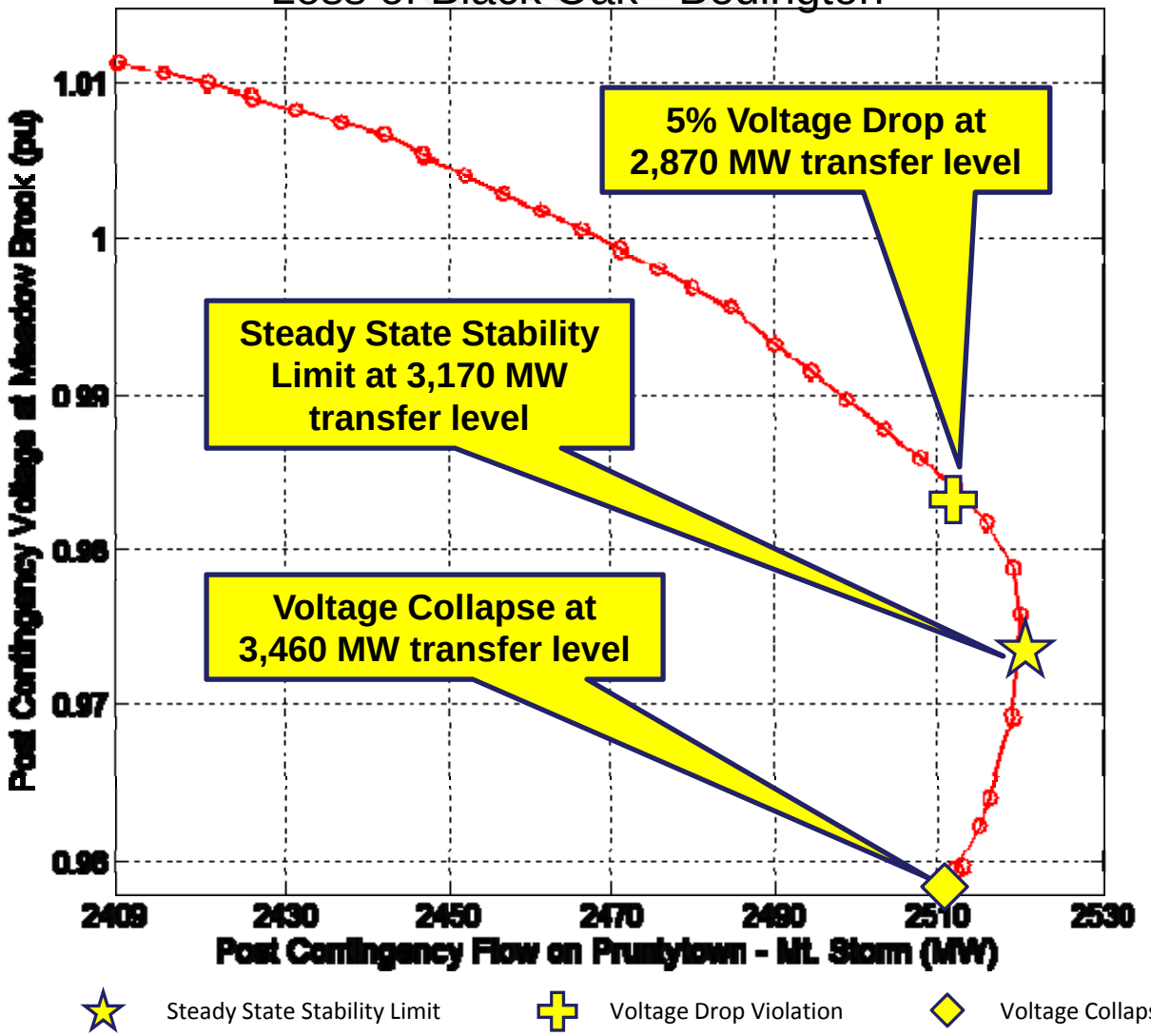
MAAC Load Deliverability - Voltage

- Several critical contingencies are non-covergent

- Keystone - South Bend 500 kV
- Conemaugh - Keystone 500 kV
- Conemaugh - Jacks Mountain 500 kV
- Keystone - Jacks Mountain 500 kV
- Jacks Mountain - Juniata 1&2 500 kV
- Conemaugh - Hunterstown 500 kV
- Hunterstown - Conastone 500 kV
- Conastone - Brighton 500 kV
- Brighton - Doubs 500 kV
- Calvert Cliffs - Waugh Chapel 500 kV
- Burches Hill - Possum Point 500 kV
- Brister - Ox 500 kV
- Elmont - Cunningham 500 kV
- Elmont - Ladysmith 500 kV
- Ladysmith - Possum Point 500 kV
- Loudoun - Morrisville 500 kV
- Morrisville - North Anna 500 kV
- Loudoun - Pleasant View 500 kV
- Meadow Brook - Loudoun 500 kV
- Mount storm - Meadow Brook 500 kV
- Mount Storm - Greenland Gap 500 kV
- Mount Storm - T157 Tap 500 kV
- T157 Tap - Doubs 500 kV
- Hatfield - Black Oak 500 kV
- Hatfield - Ronco 500 kV
- Hatfield - Banyan Run 500 kV
- Bedington - Black Oak 500 kV
- Bedington - Doubs 500 kV
- Fort Martin - Ronco 500 kV
- Yukon - South Bend 500 kV
- Yukon - Banyan Run 500 kV
- Cabot - Cranberry 500 kV
- Cranberry - Wylie Ridge 500 kV
- Calvert Cliffs 1&2 500 kV
- P04 500 kV
- Susquehanna #2

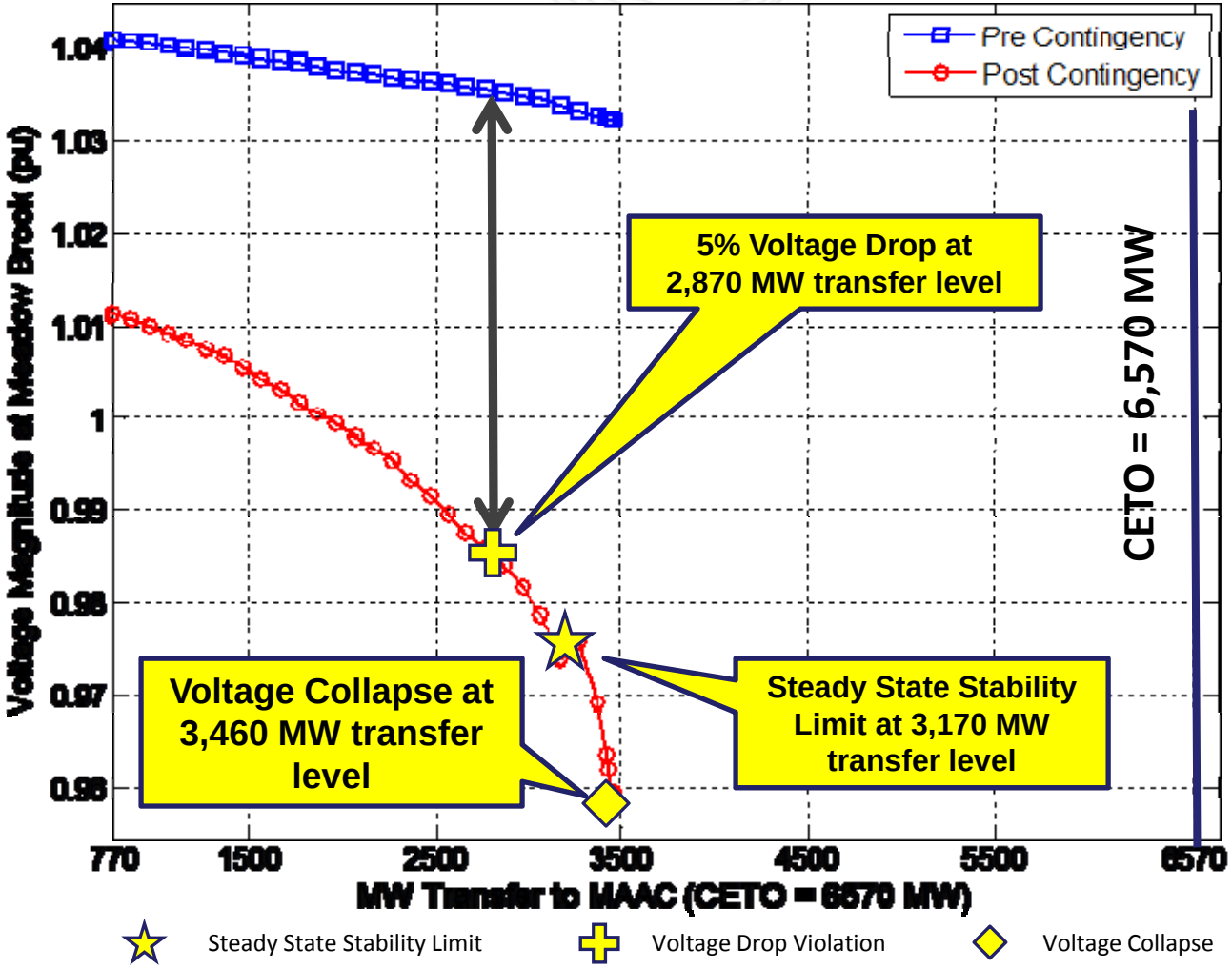
MAAC Load Deliverability - Voltage

Loss of Black Oak - Bedington



MAAC Load Deliverability - Voltage

Loss of Black Oak - Bedington

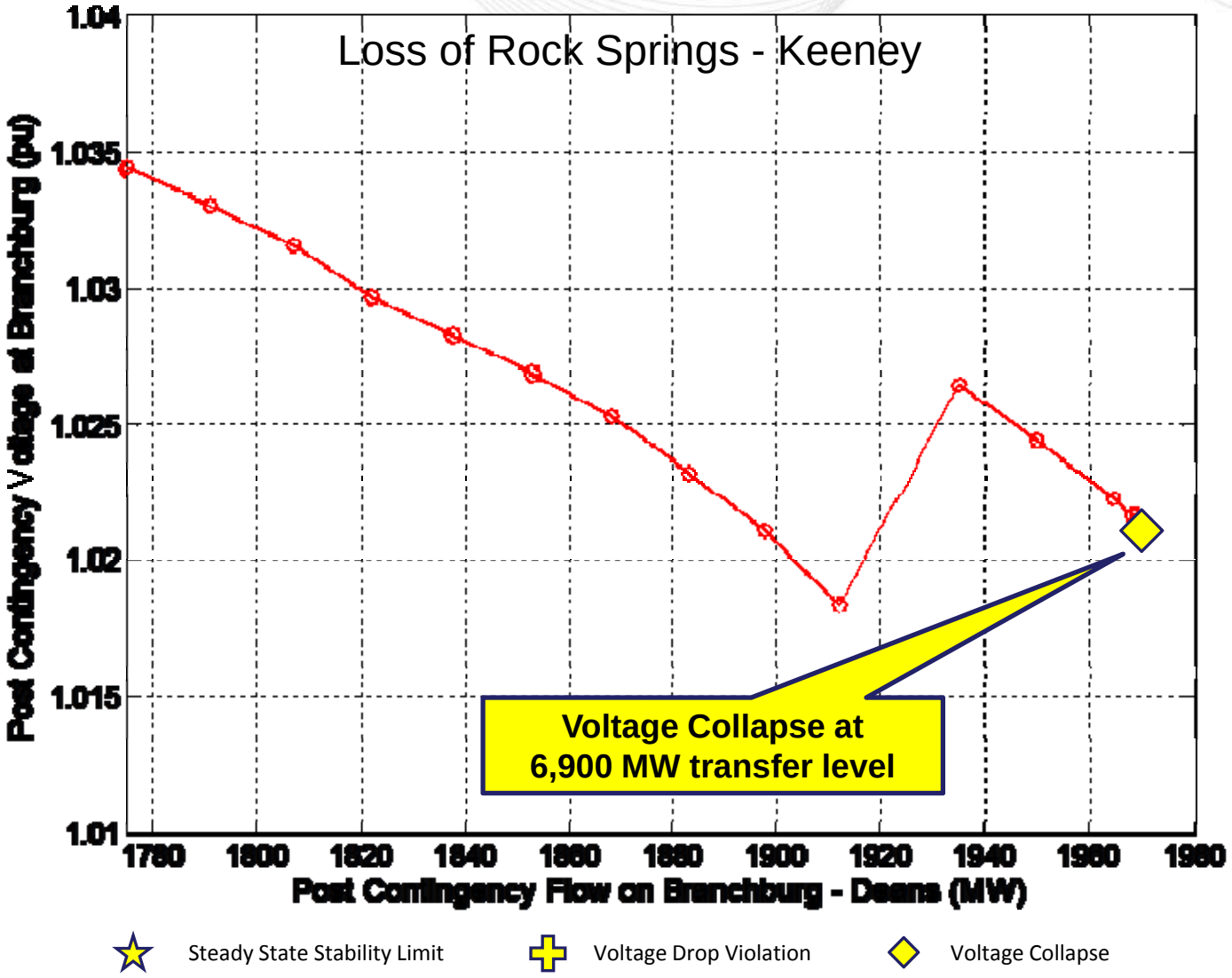


EMAAC Load Deliverability - Voltage

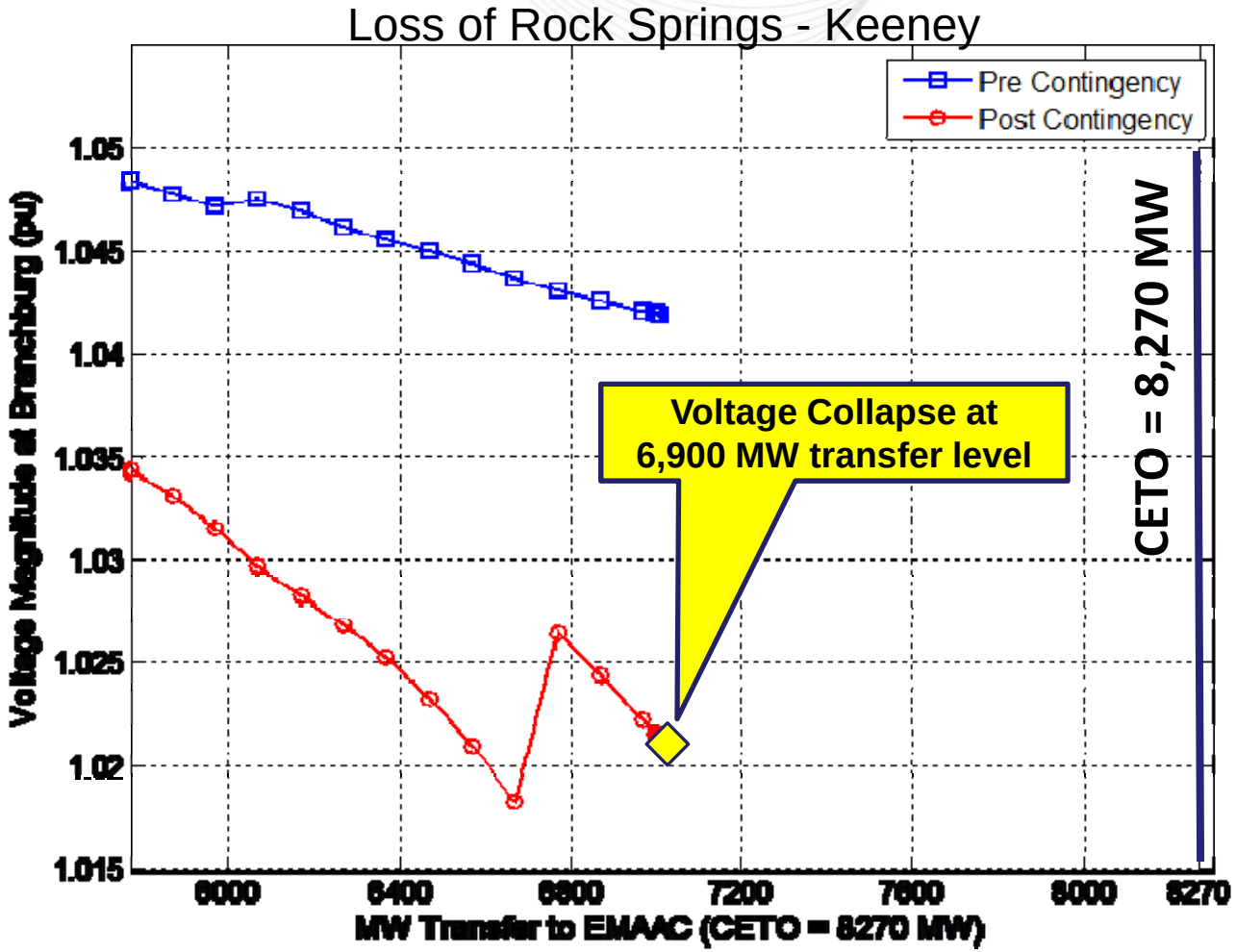
- Several critical contingencies are non-convergent

- Red Lion to Hope Creek 500 kV
- New Freedom to East Windsor 500 kV
- Conemaugh to Hunterstown 500 kV
- Hunterstown to Conastone 500 kV
- Susquehanna to Lackawanna 500 kV
- Lackawanna to Hopatcong 500 kV
- Hopatcong to Roseland 500 kV
- Keeney to Rock Springs 500 kV
- Rock Springs to Peach Bottom 500 kV
- Peach Bottom to Limerick 500 kV
- Alburtis to Branchburg 500 kV
- Smithburg to Deans 500 kV
- Keystone to Jacks Mt. 500 kV
- Branchburg to Elroy 500 kV
- Ford Mill 600 MW generator
- Ford Mill 600 MW generator
- Branchburg 400 MVAR capacitor
- Bergen 550 MW generator
- Linden 750 MW generator

EMAAC Load Deliverability - Voltage



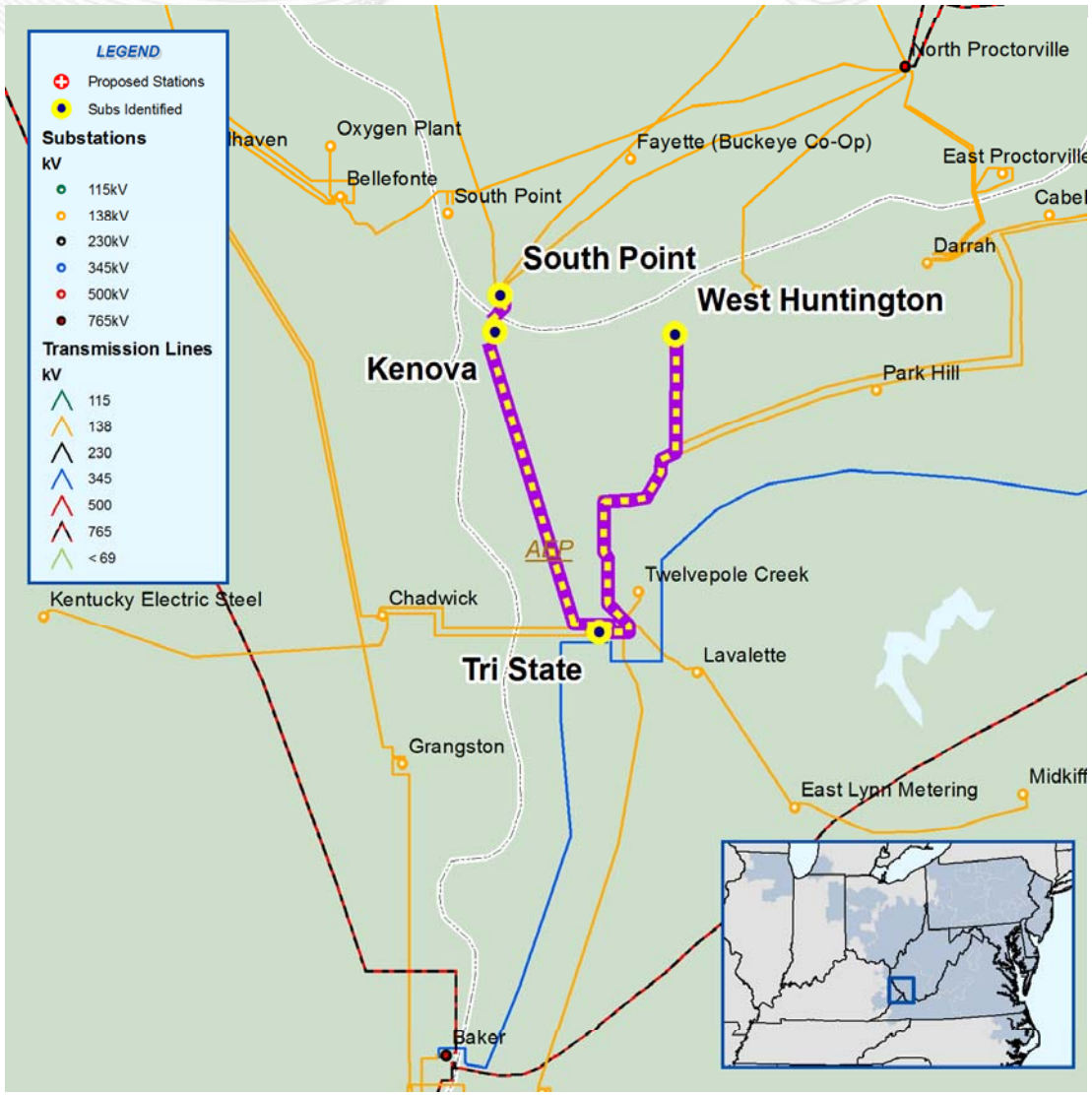
EMAAC Load Deliverability - Voltage



Steady State Stability Limit Voltage Drop Violation Voltage Collapse

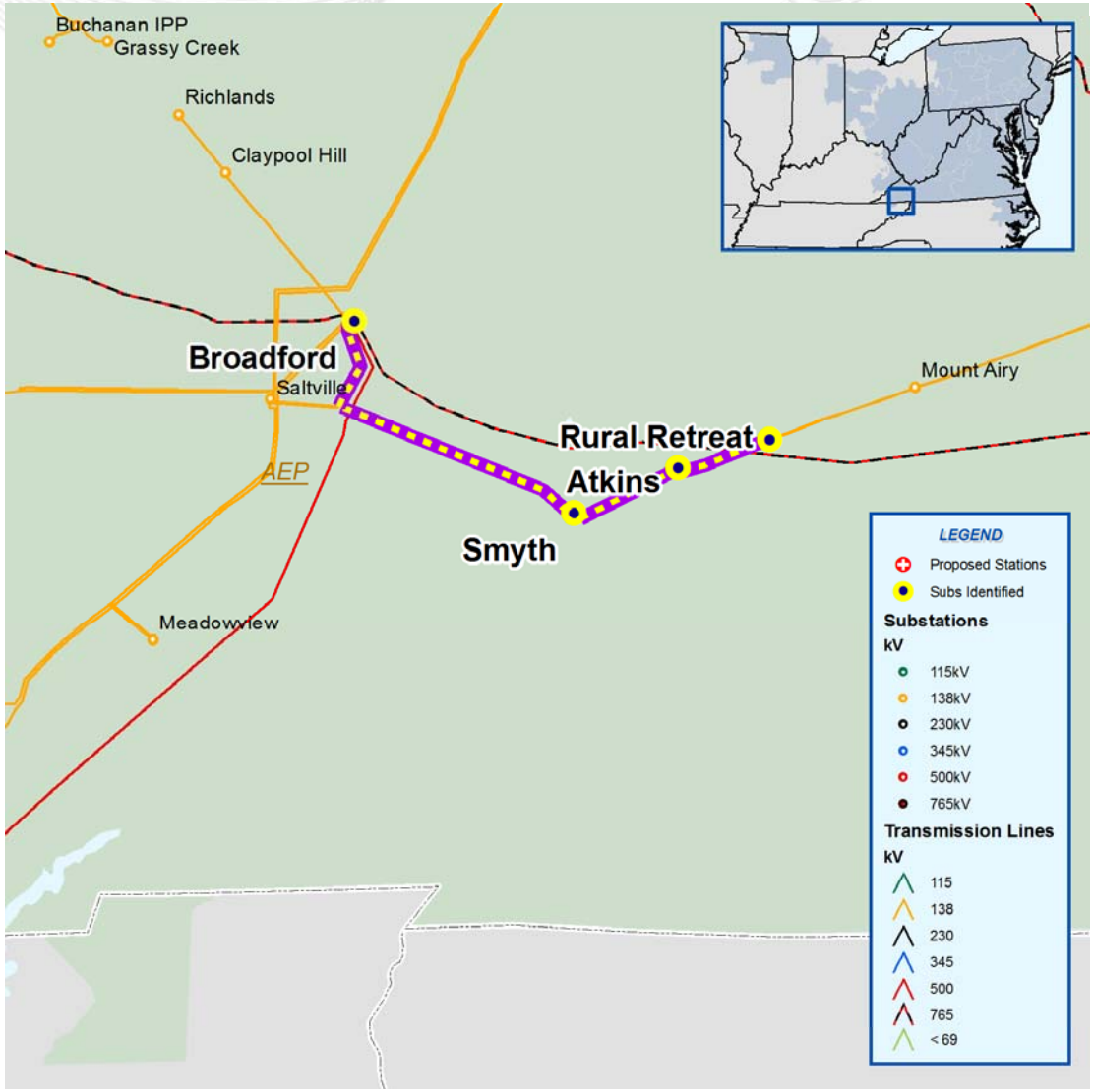
AEP Transmission Zone

- Potential generator deliverability violations
- Tristate – Kenova 138 kV line overload for the loss of the Baker 765/345 kV transformer
- Kenova – South Point 138 kV line overload for the loss of the Baker 765/345 kV transformer
- Tristate – West Huntington 138 kV line overload the loss of the Baker 765/345 kV transformer



AEP Transmission Zone

- Potential common mode outage violations
- Broadford - Smyth 138 kV line overload for the stuck breaker contingency with the loss of the Jackson Ferry – Cloverdale 765 kV line and Jackson Ferry 765/138 kV transformer #2, or for the stuck breaker contingency with the loss of the Jackson Ferry – Broadford 765 kV line and Jackson Ferry 765/138 kV transformer #2
- Smyth - Atkins 138 kV line overload for the stuck breaker contingency with the loss of the Jackson Ferry – Cloverdale 765 kV line and Jackson Ferry 765/138 kV transformer #2
- Atkins– Rural Retreat 138 kV line overload for the stuck breaker contingency with the loss of the Jackson Ferry – Cloverdale 765 kV line and Jackson Ferry 765/138 kV transformer #2

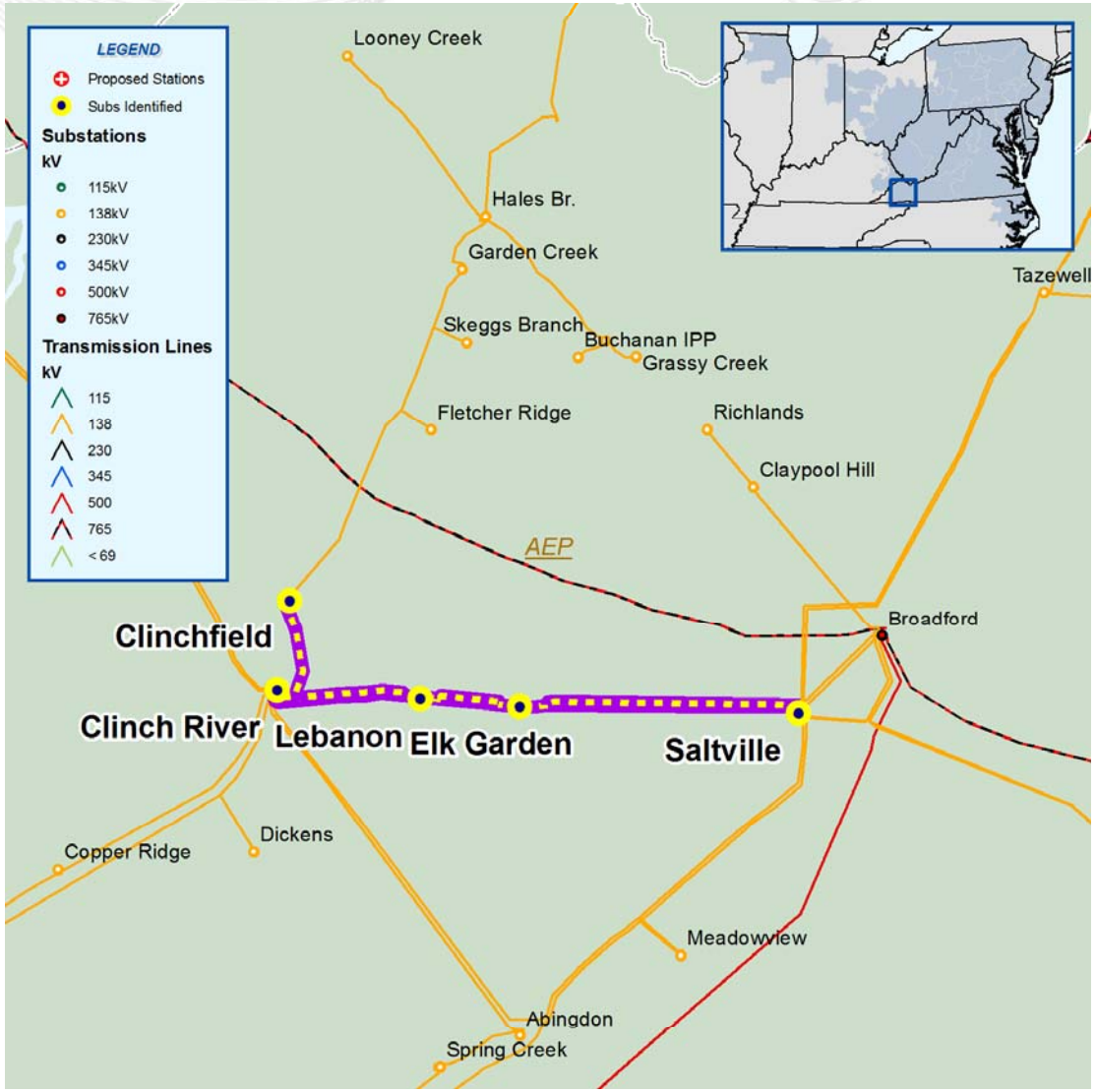


AEP Transmission Zone

- Potential common mode outage violations
- Otter – Johnson Mountain – New - London 138 kV line overload for several contingencies

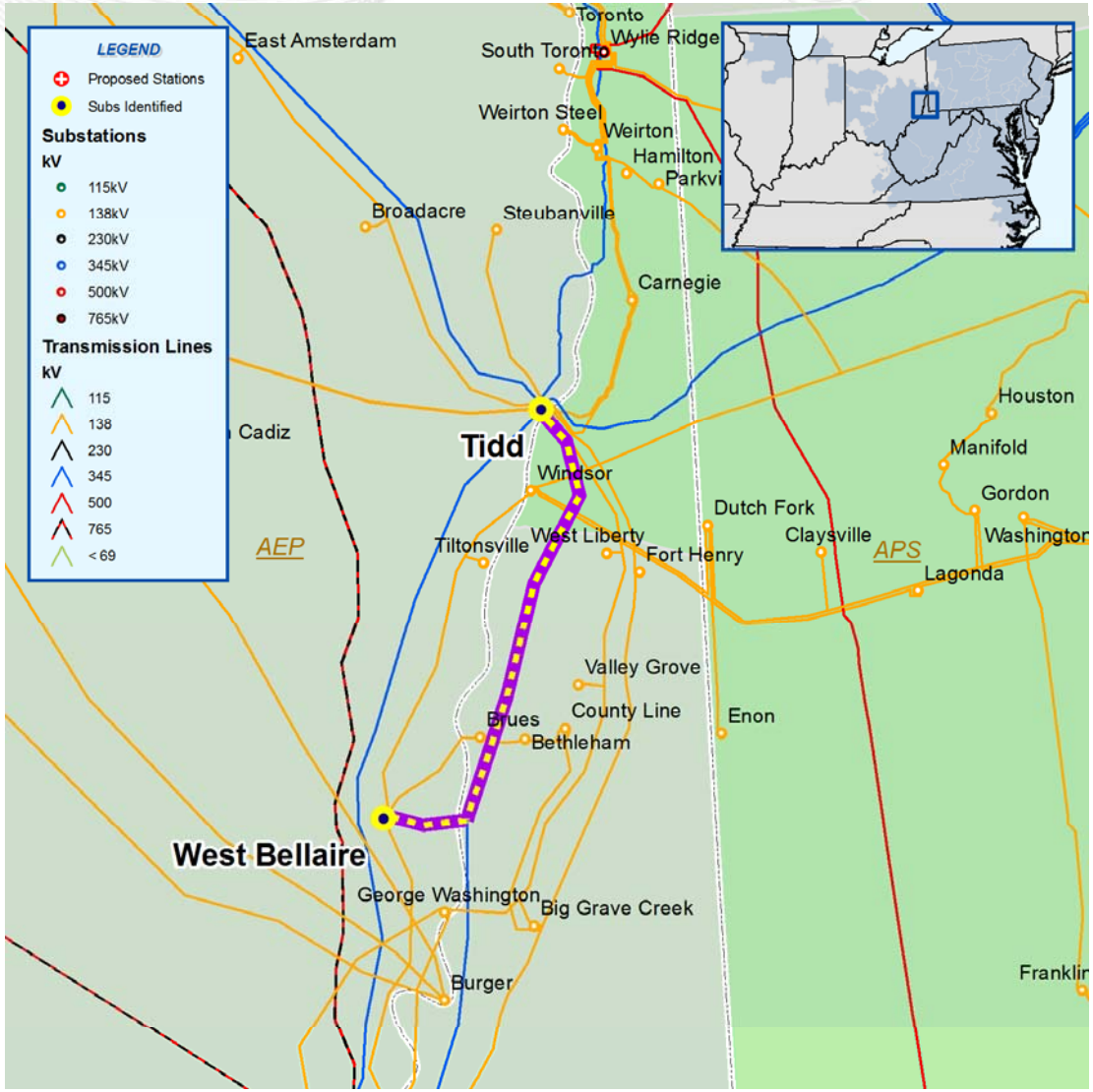
AEP Transmission Zone

- Potential common mode outage violations
- Wolf Hill – North Bristol 138 kV line overload for several contingencies
- Elk Garden - Saltville 138 kV line overload for several contingencies
- Clinch River - Lebanon 138 kV line overload for several contingencies
- Clinch River - Clinchfield 138 kV line overload for the loss of the Clinch River – Freemont 138 kV line



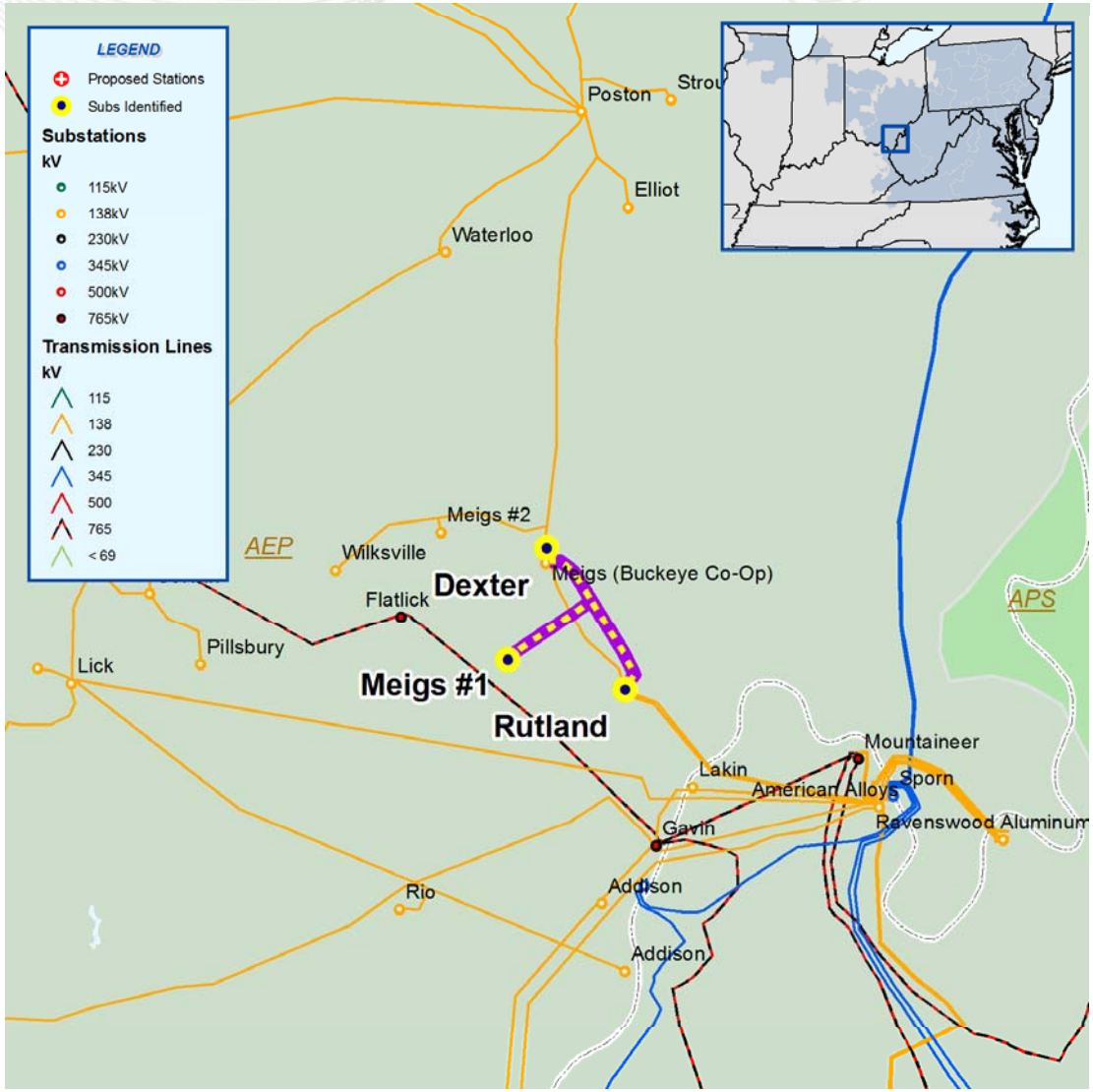
AEP Transmission Zone

- Potential common mode outage violations
- West Bellaire – Tidd 345 kV line overload for the line with stuck breaker contingency with loss of Kammer – South Canton 765 kV line, Kammer 765/500 kV transformer, South Canton 765/345 transformer #3, 502 Junction – Kammer 500 kV line and the South Canton 345/138 kV transformer



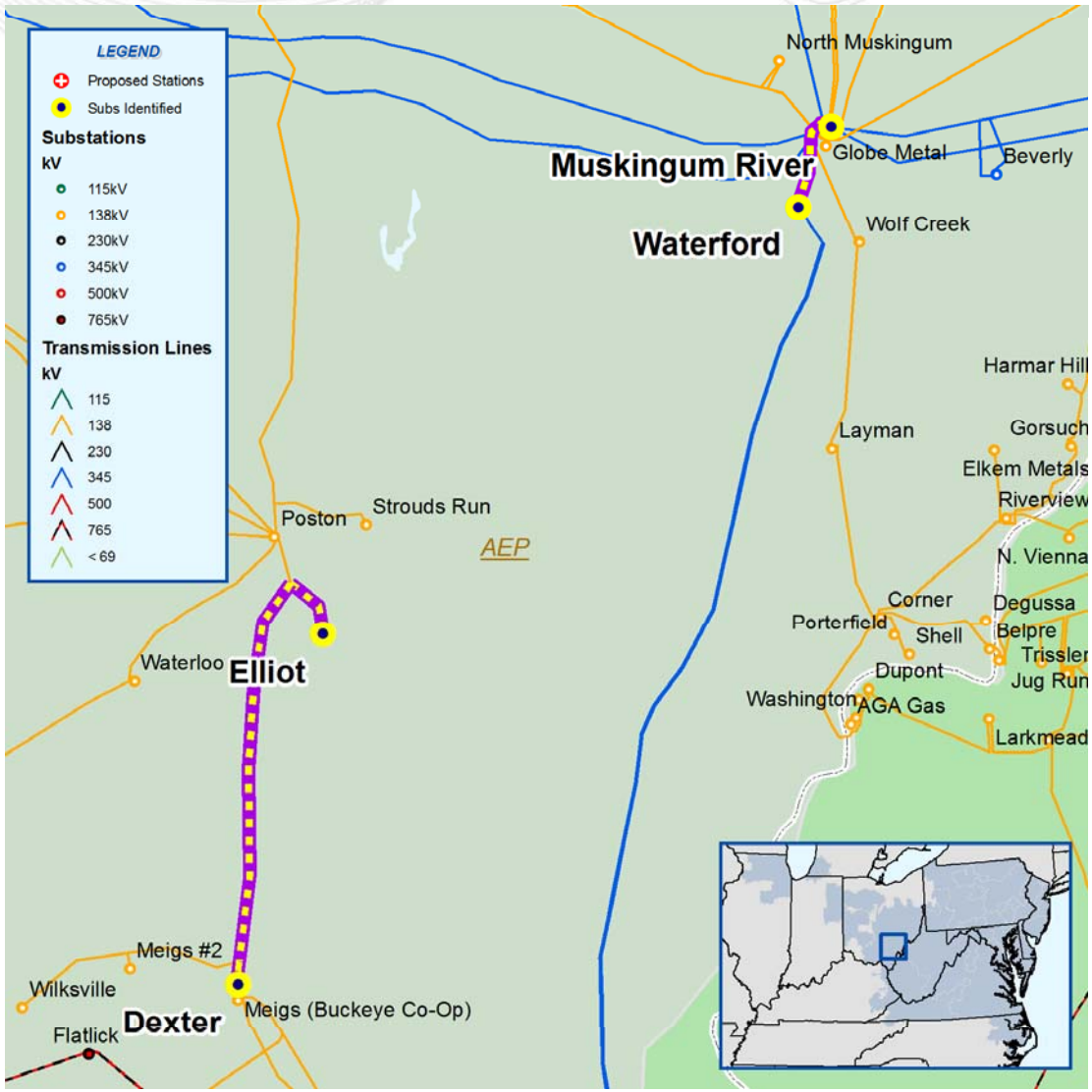
AEP Transmission Zone

- Potential common mode outage violations
- Rutland – Meigs Mine 138 kV line overload for the loss of Muskingum - Waterford 345 kV line or further loss Muskingum unit #2
- Meigs Mine - Dexter 138 kV line overload for the loss of Muskingum - Waterford 345 kV line or further loss Muskingum unit #2
- SOLIDA – Bellefonte 138 kV line overload for the loss of the North Proctorville – SOLIDA 138 kV line



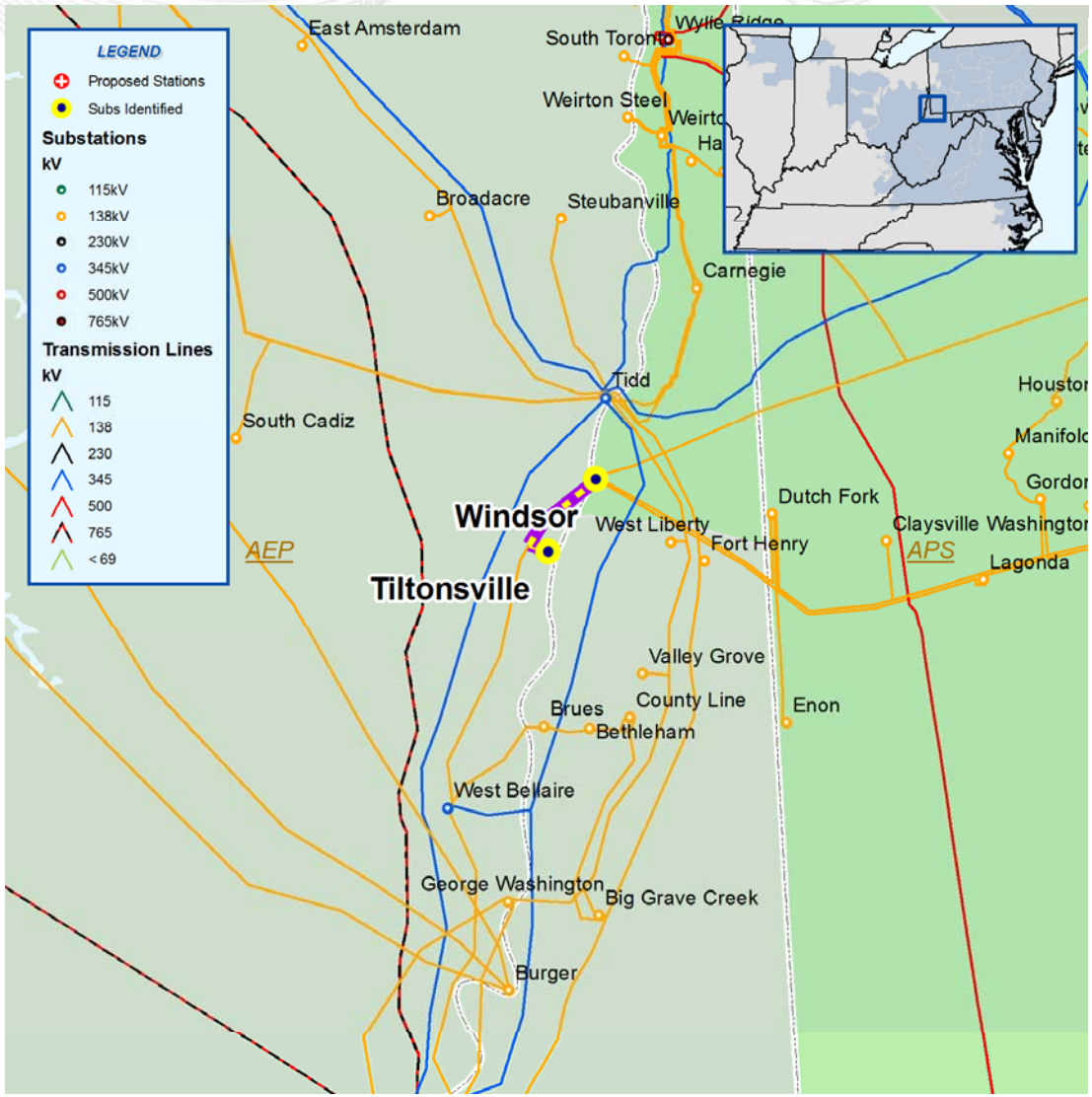
AEP Transmission Zone

- Potential generator deliverability violations
- Dexter – Elliot 138 kV line overload for the loss of Muskingum – Waterford 345 kV line
- Waterford – Muskingum River 345 kV line overload for the non-contingency condition
- Muskingum River 345/138 kV transformer overload for several contingencies



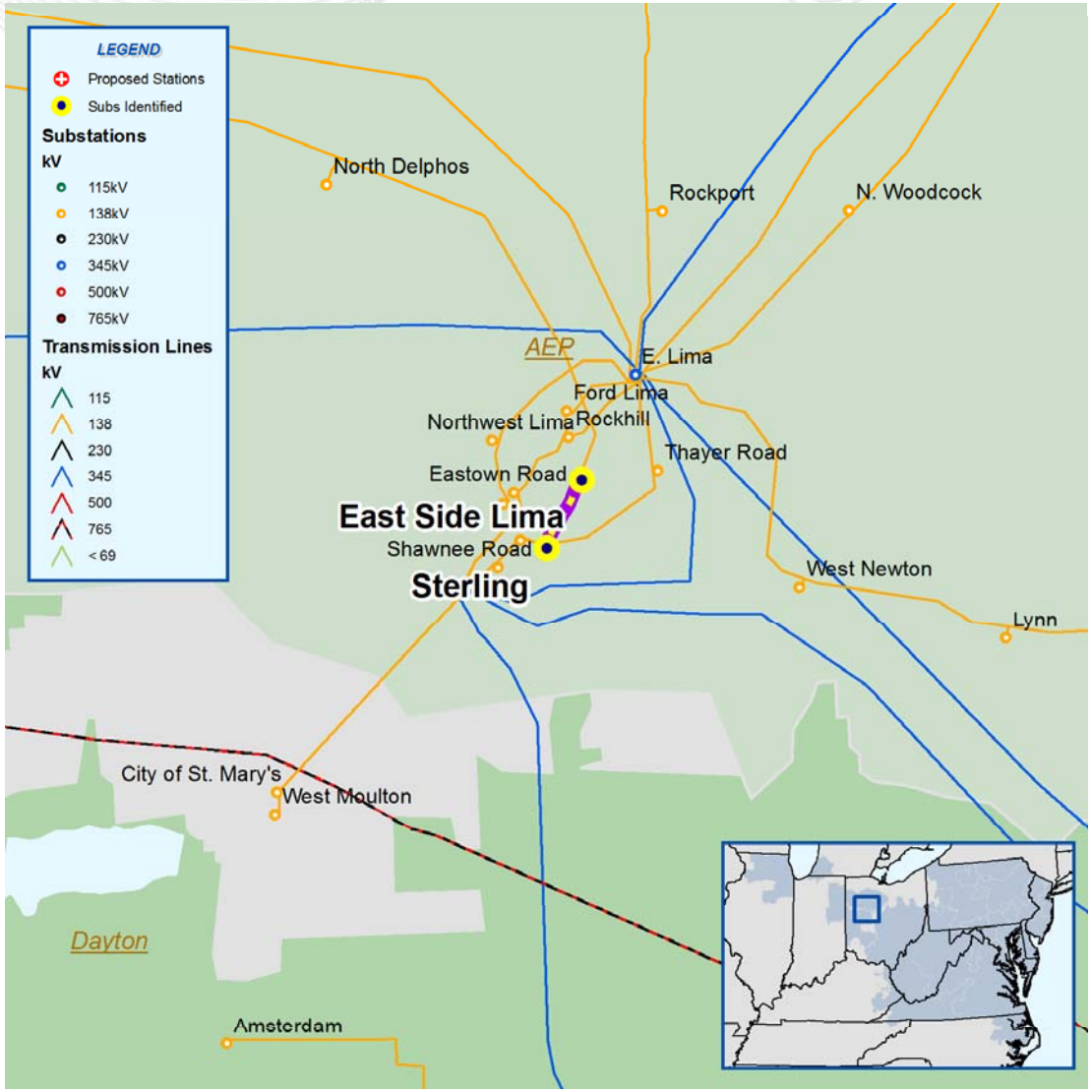
AEP Transmission Zone

- Potential generator deliverability violations
- Tiltonsville – Windsor 138 kV line overload for several contingencies



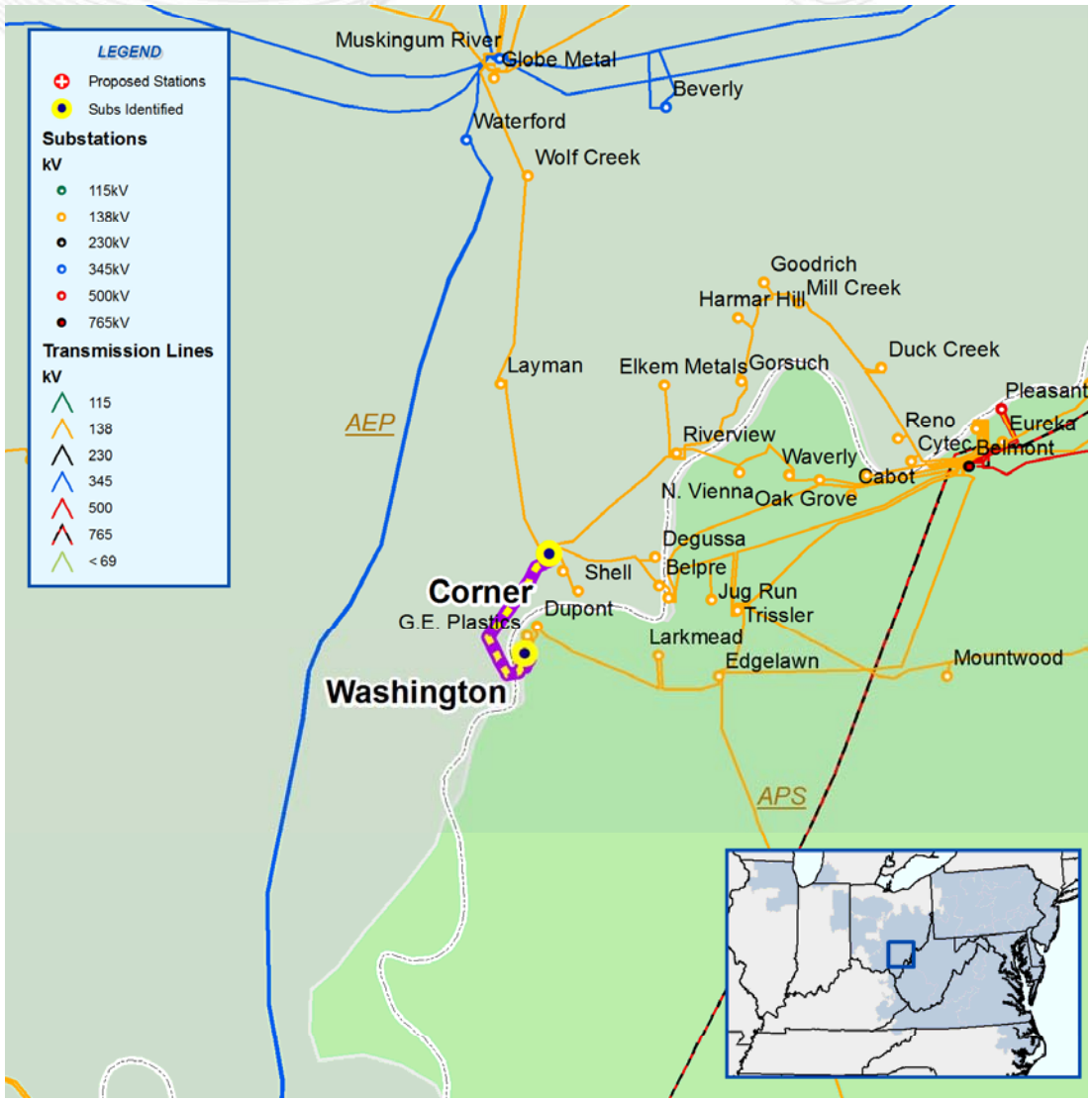
AEP Transmission Zone

- Potential generator deliverability violations
- Sterling – East Side 138 kV line overload for several contingencies



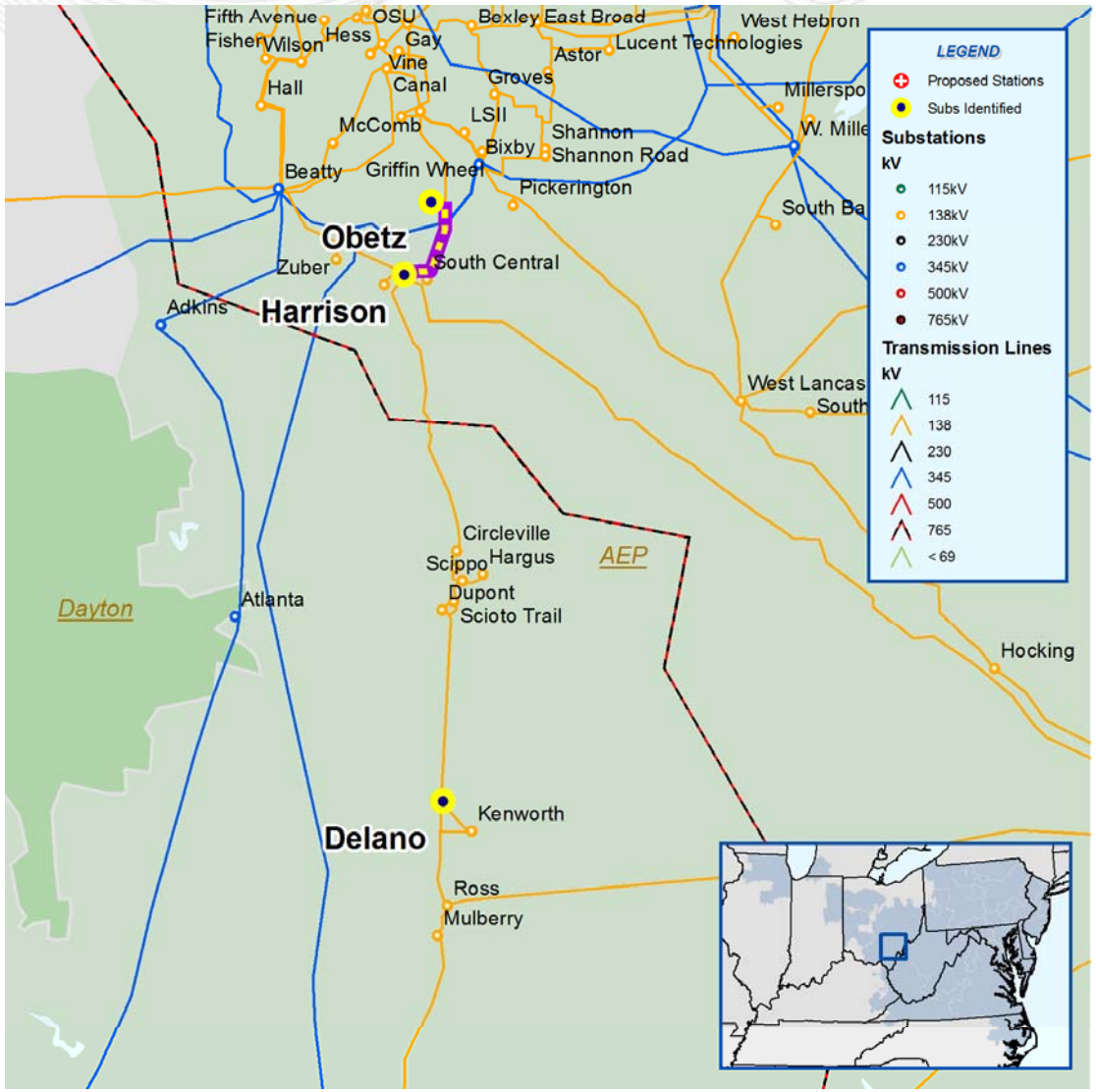
AEP Transmission Zone

- Potential common mode outage violation
- Corner – Washington 138 kV line overload for the common tower outage of the Belmont – Trissler 138 kV line #1 and the Belmont – Edgelawn 138 kV line
- Ross – S Delano 138 kV line overload for several contingencies
- Circleville – Harrison 138 kV line overload for several contingencies
- Stroud Z – Stroud 138 kV line overload for the loss of the Dexter – Elliot - Poston138 kV line



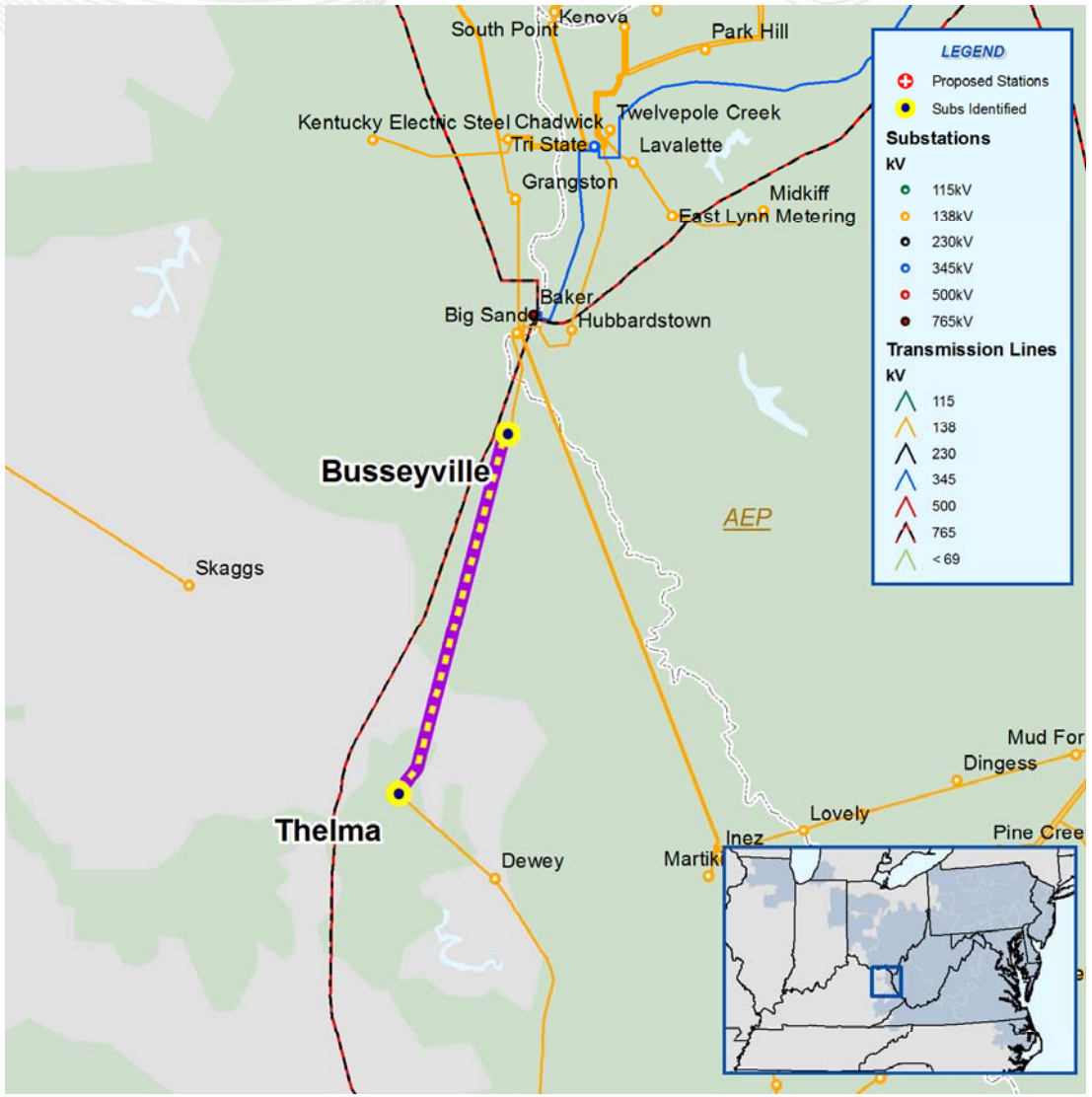
AEP Transmission Zone

- Potential common mode outage violations
- S Delano - Delano138 kV line overload for several contingencies
- Harris – Obetz 138 kV line overload for the line with stuck breaker contingency with the loss of Bixby – N Fork 345 kV line and Bixby 345/138 kV transformer #1 and #2



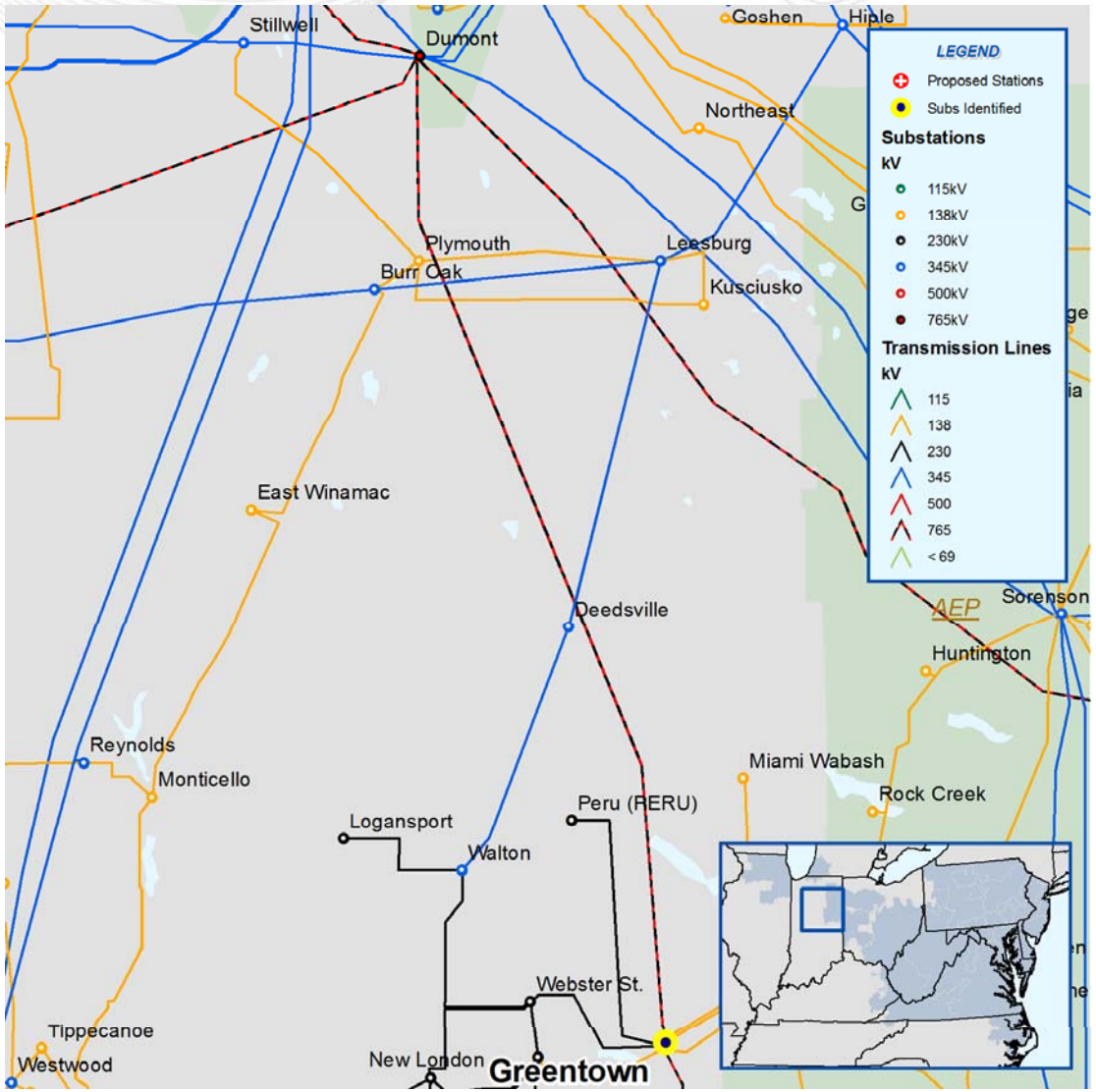
AEP Transmission Zone

- Potential common mode outage violations
- Busseyville – Thelma 138 kV line overload for the line with stuck breaker contingency with the loss of Baker – Broadford 765 kV line and Baker 765/345 kV transformer



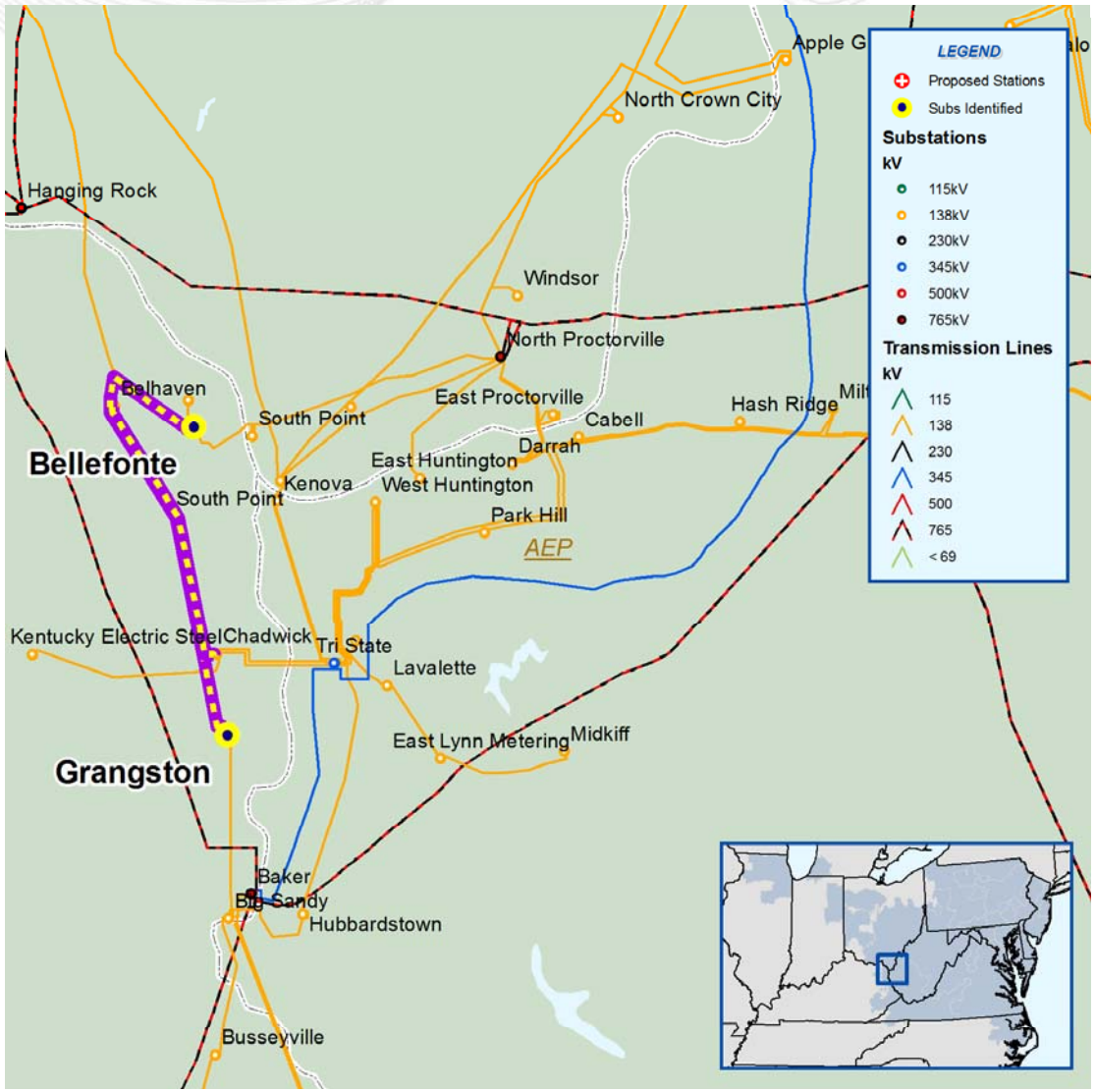
AEP Transmission Zone

- Potential common mode outage violations
- Greentown 765/138 kV transformer overload for the line with stuck breaker contingency with the loss of the Dumont – Greentown 765 kV line and Greentown three winding transformer



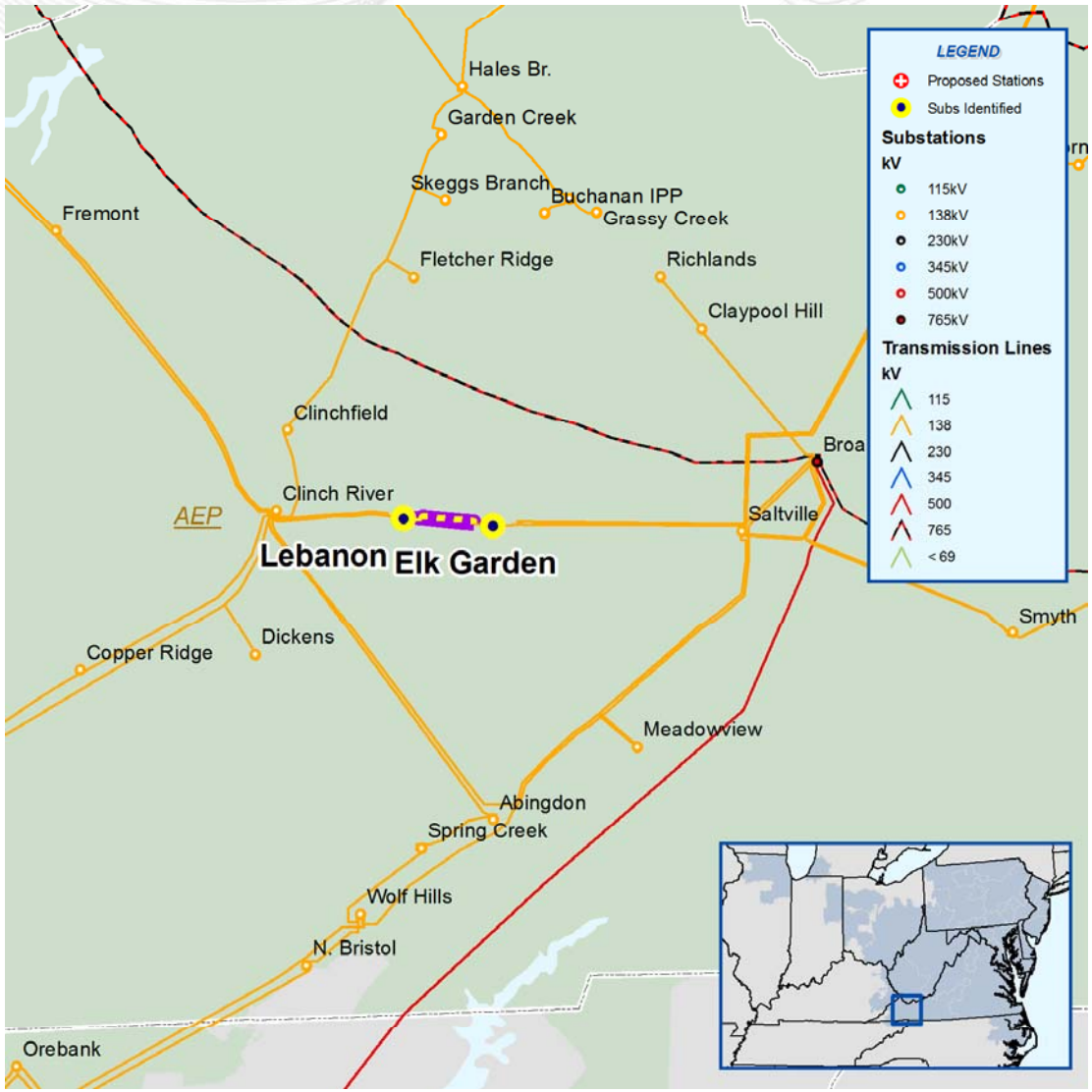
AEP Transmission Zone

- Potential common mode outage violations
- Grangston – Bellefonte 138 kV line overload for the loss of the Baker 765/345 kV transformer



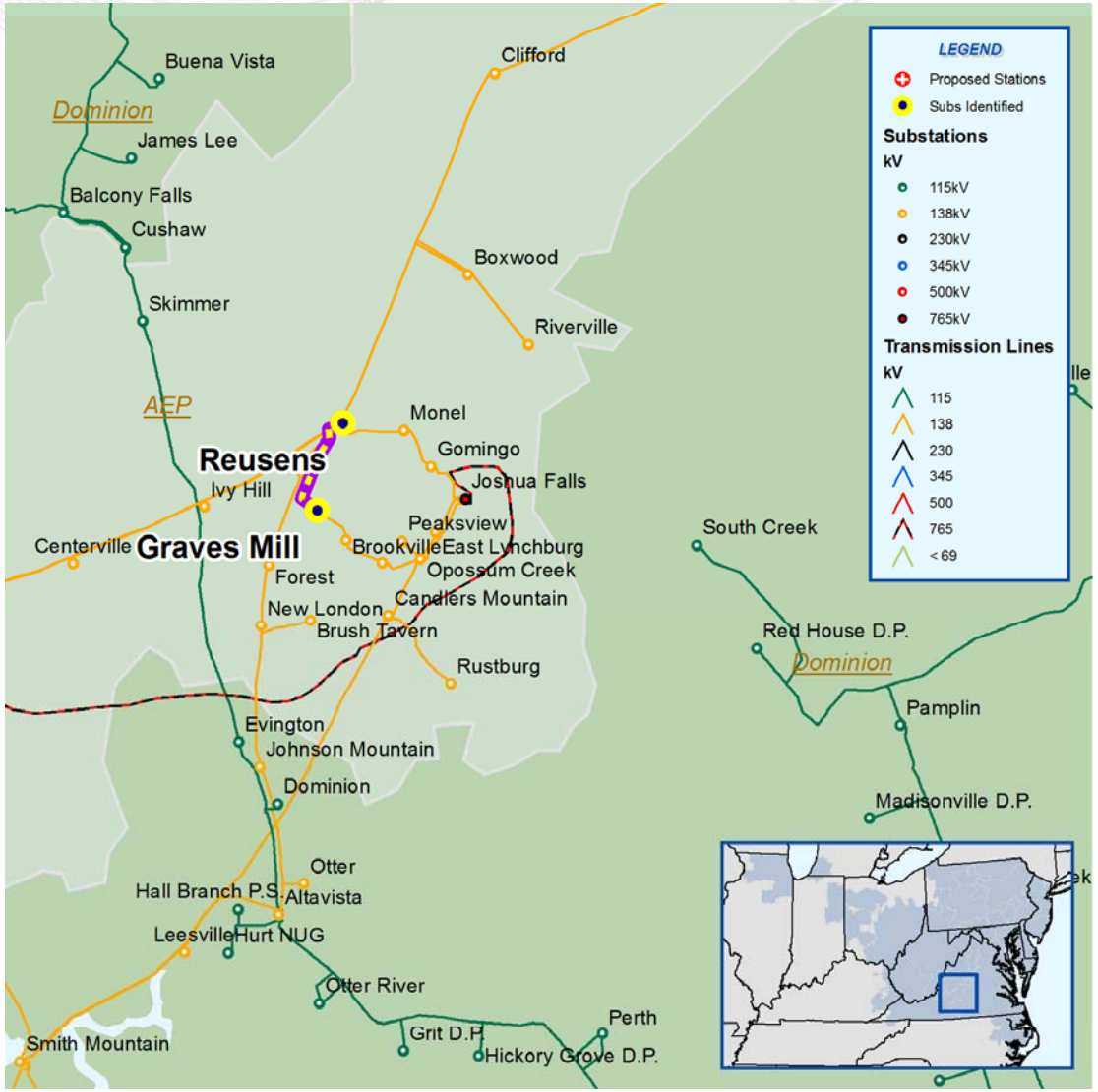
AEP Transmission Zone

- Potential common mode outage violations
- Lebanon – Elk Garden 138 kV line overload for the tower outage of the Dorton – Fremo 138 kV line and the Flemin – Dorton – Clinch River 138 kV line



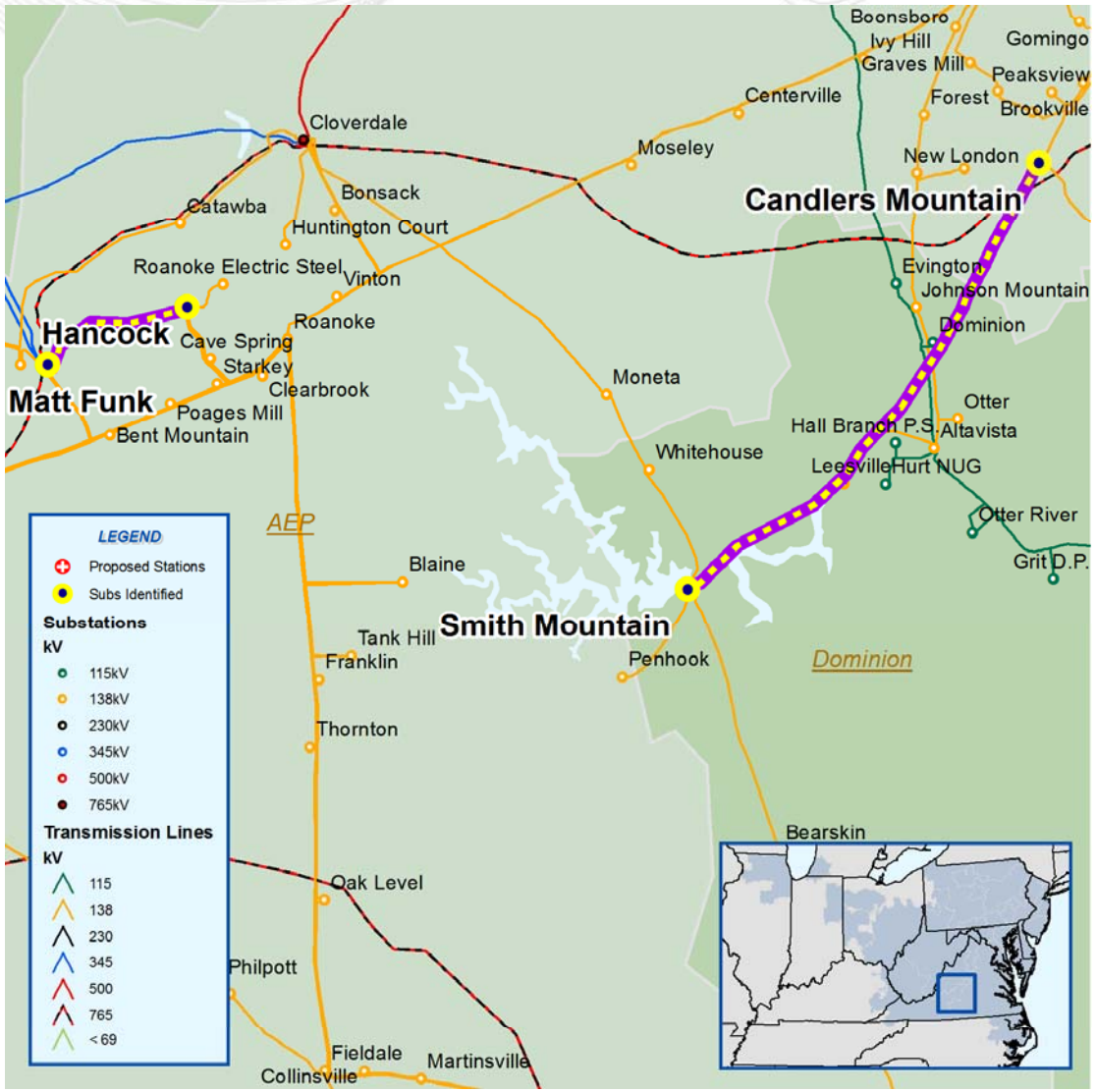
AEP Transmission Zone

- Potential common mode outage violations
- Reusen – Graves Mill 138 kV line overload for the tower outage of the E. Lynchburg – Joshua 138 kV line and the Joshua – Opossum Creek 138 kV line



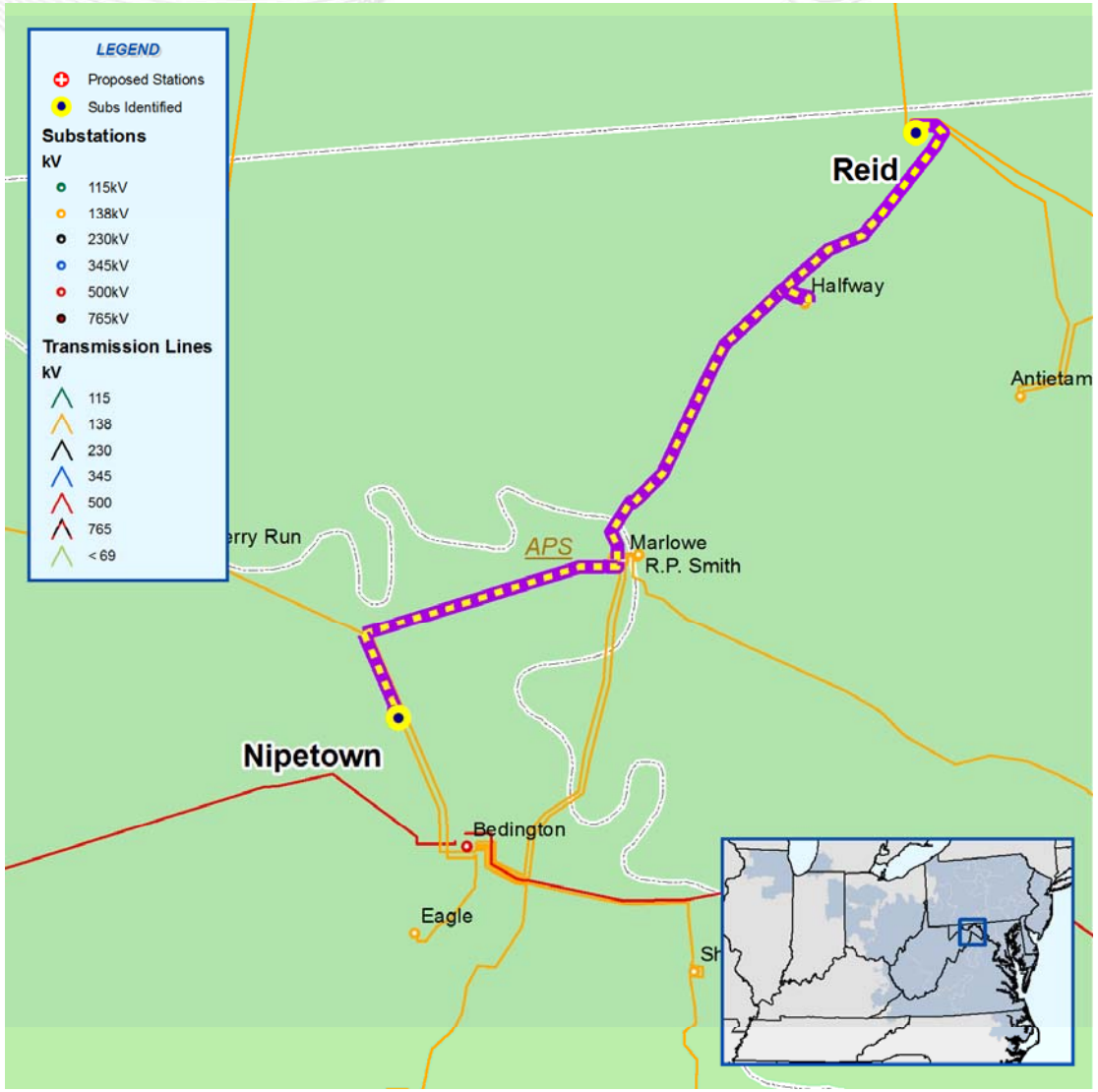
AEP Transmission Zone

- Potential common mode outage violations
- Smith Mountain – Candlers Mountain 138 kV line overload for several contingencies
- Matt Funk – Hancock 138 kV line overload for the line with stuck break contingency with the loss of Cloverdale – Jacksons Ferry 765 kV line, Cloverdale - Joshua 765 kV line, Cloverdale 765/345 kV transformer and Cloverdale – matt Funk 345 kV line



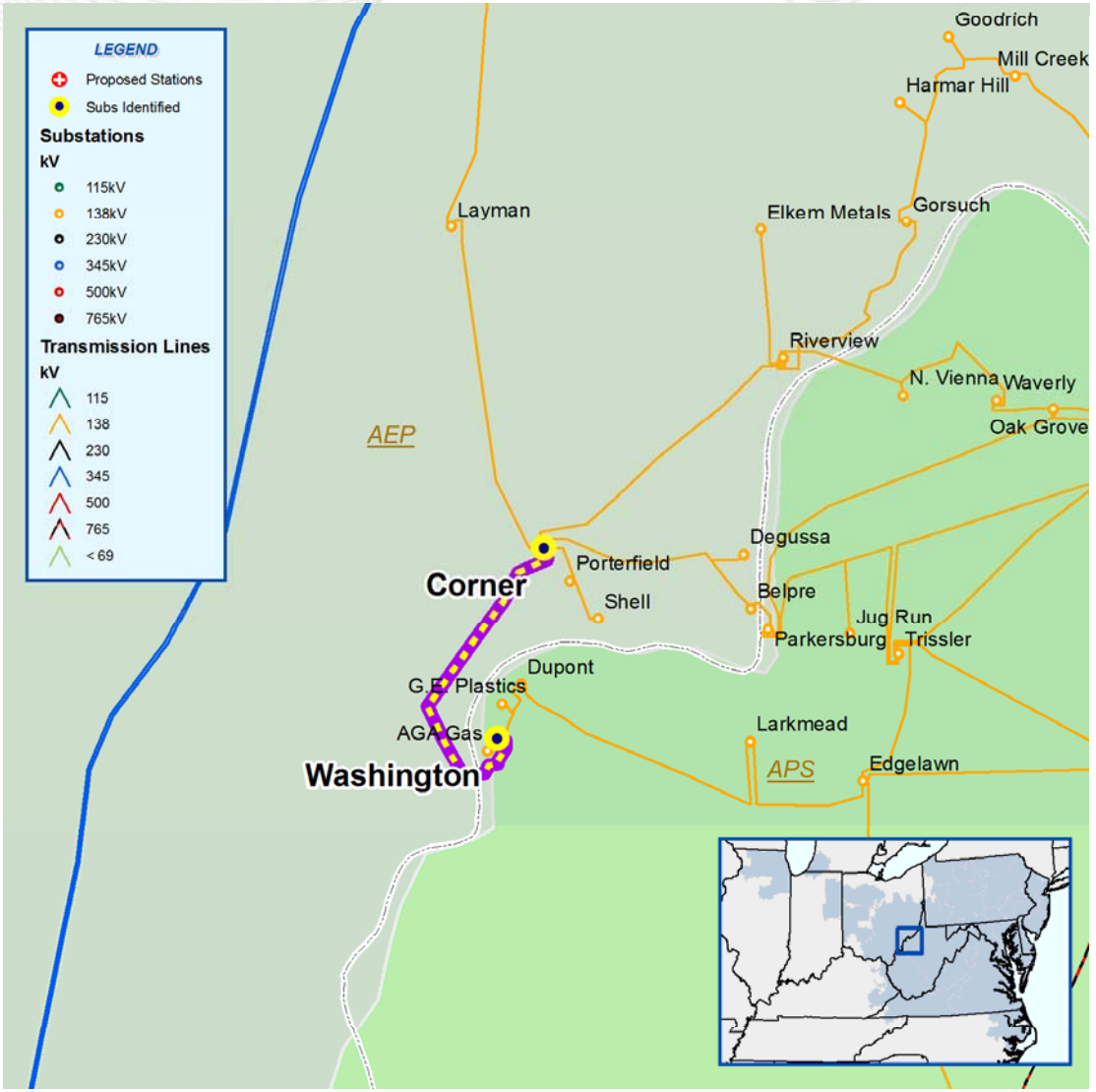
APS Transmission Zone

- Potential generator deliverability violations
- For the common mode outage test the Nipetown - Reid 138 kV line is overloaded for the fault of the Marlowe - Harmony Junction 138 kV line with a breaker failure at Marlowe
- Potential Recommended Solution: Reconductor Nipetown - Reid with 1033 ACCR 54/19
- Expected In-Service Date: 06/01/2015



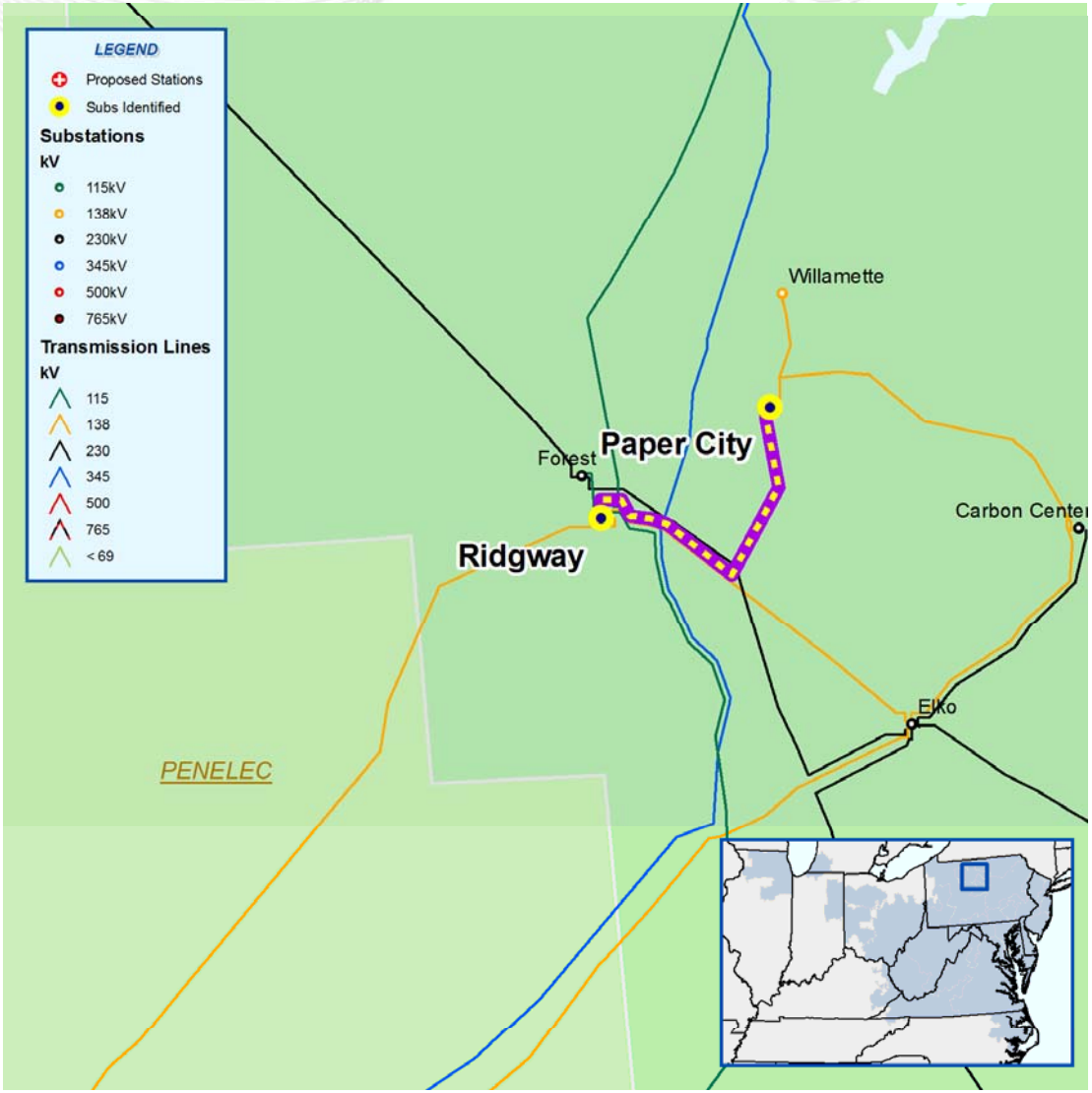
APS Transmission Zone

- Potential generator deliverability violations
- Common mode outage violation on Corner - Washington 138 kV line is overloaded for the tower outage of the Belmont – Trissler 138 kV line #1 and the Belmont – Edgelawn 138 kV line
- Potential Reccomended Solution: Upgrade Terminal Equipment at Washington 138kV
- Expected In-Service Date: 06/01/2015



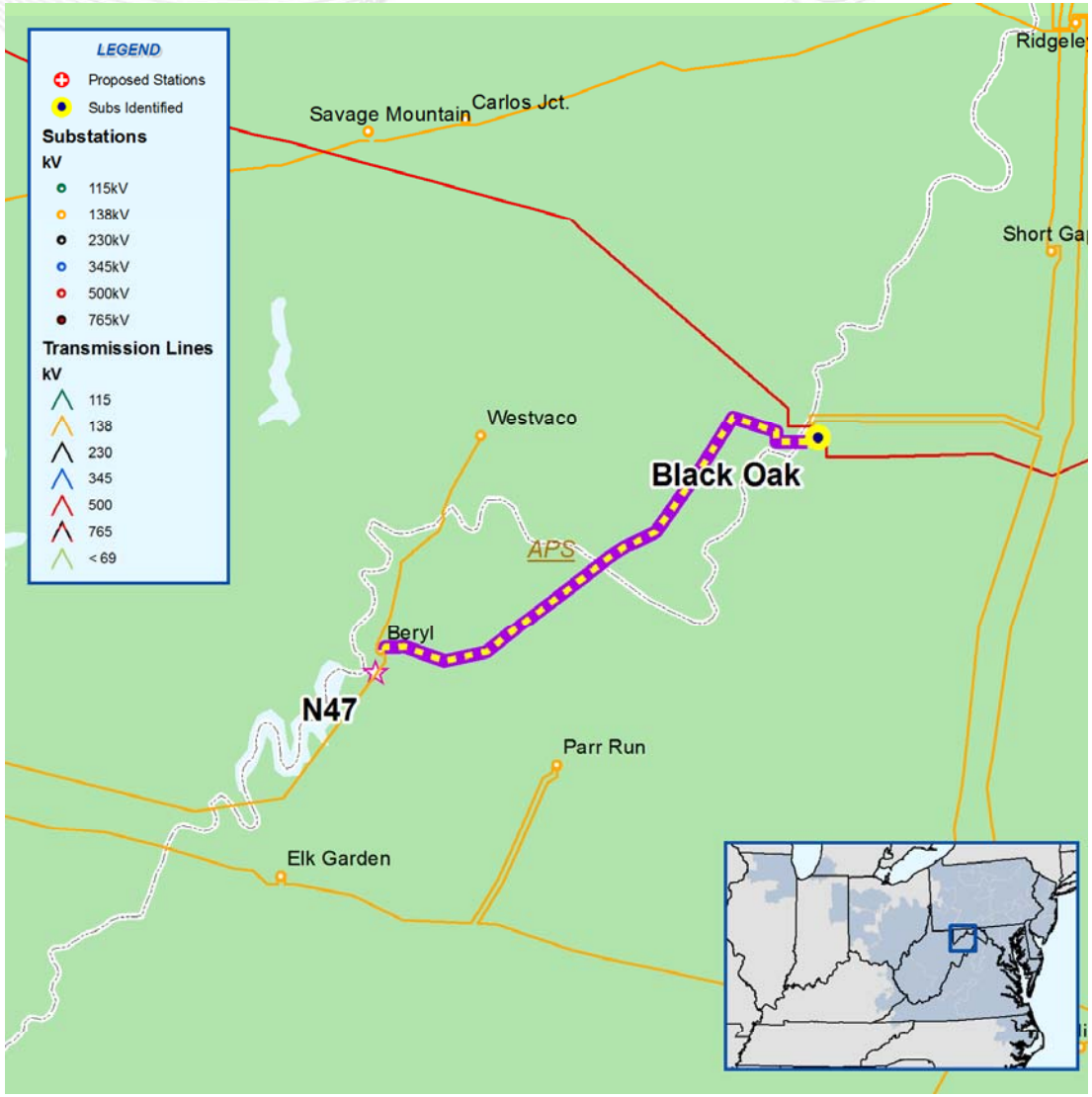
APS Transmission Zone

- Potential generator deliverability violations
- For the common mode outage test the Ridgeway – Paper City 138 kV line is overloaded for the tower outage of the Elko 230 kV #4 Breaker Failure - Tie Breaker
- Potential Recommended Solution: Replace Structures between Ridgeway and Paper City
- Estimated In-Service Date: 06/01/2015



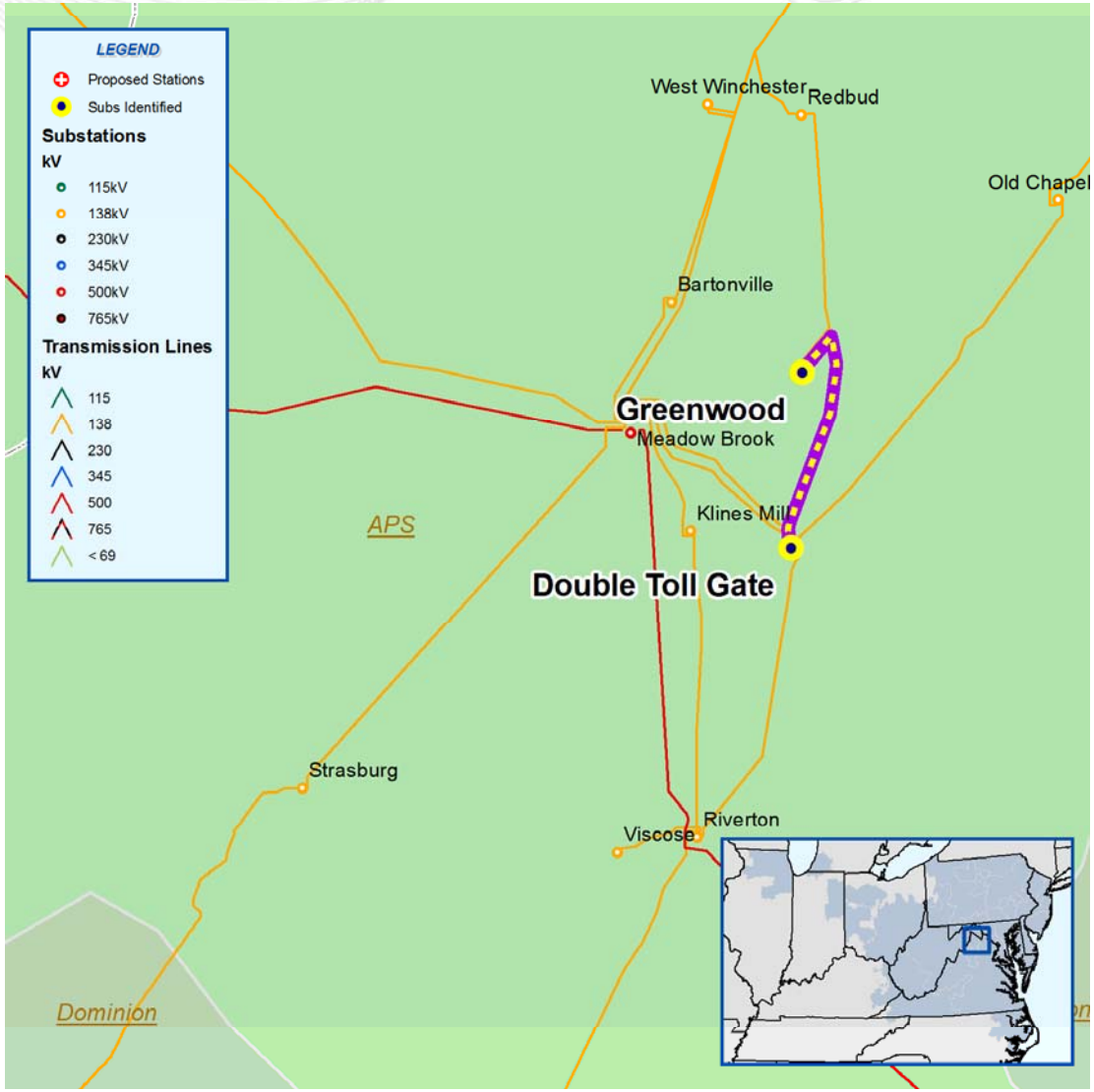
APS Transmission Zone

- Potential generator deliverability violations
- Common mode outage violation on the N47 Tap – Black Oak 138 kV line is overloaded for the Black Oak – Hatfield 500 kV line fault with stuck breaker Black Oak #4 or Black Oak500 #5
- Potential Recommended Solution: Reconductor the Albright - Black Oak 138 kV line with 795 ACSS
- Expected In-Service Date : 06/01/2015



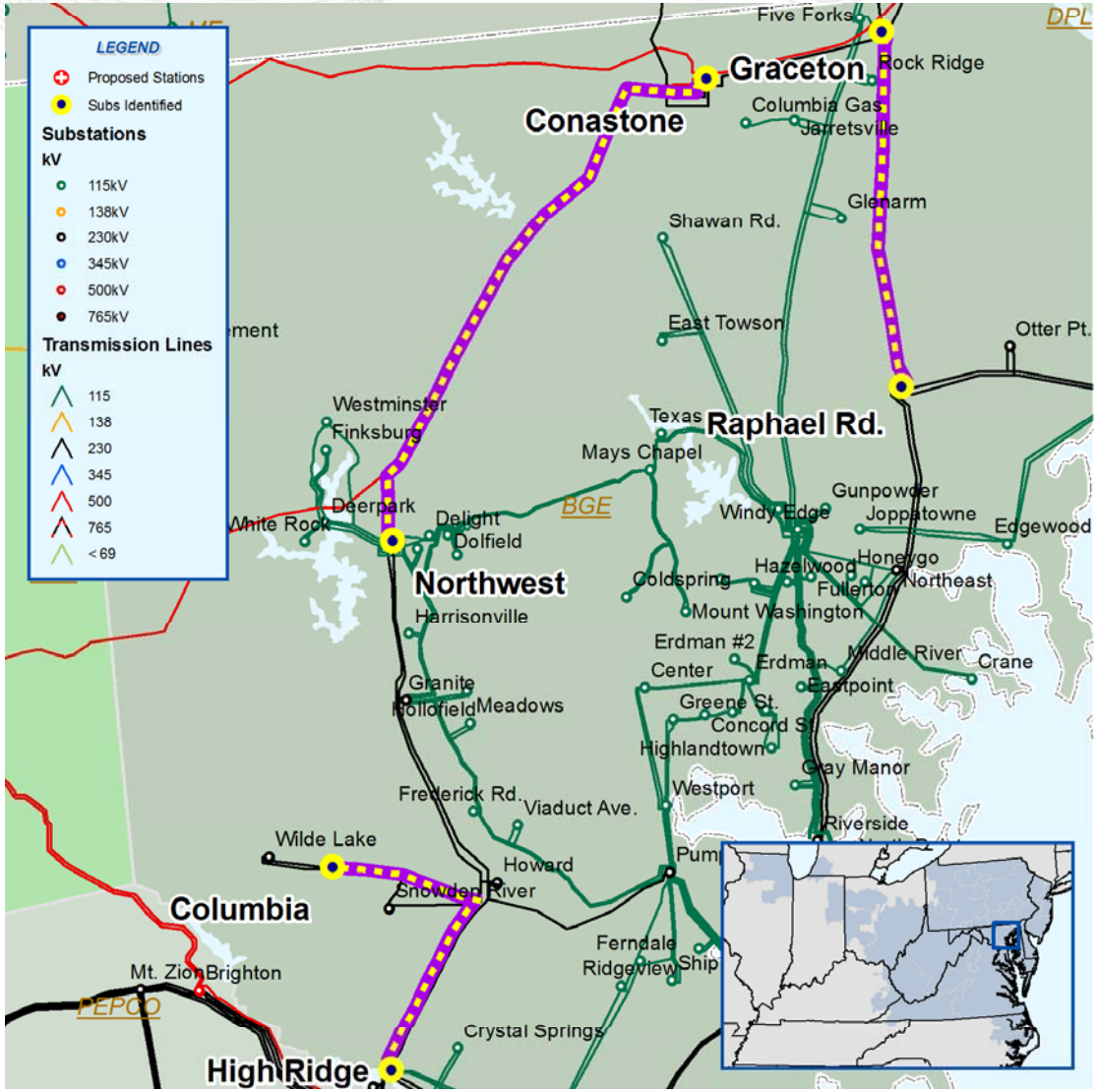
APS Transmission Zone

- Potential generator deliverability violations
- For the generator deliverability test the Double Tollgate - Greenwood 138 kV line is overloaded for the loss of the Meadow Brook – West Winchester 138 kV line
- Potential Reccomended Solution: Reconductor Double Toll Gate - Greenwood 138 kV with 954 ACSR conductor
- Expected In-Service Date: 06/01/2013



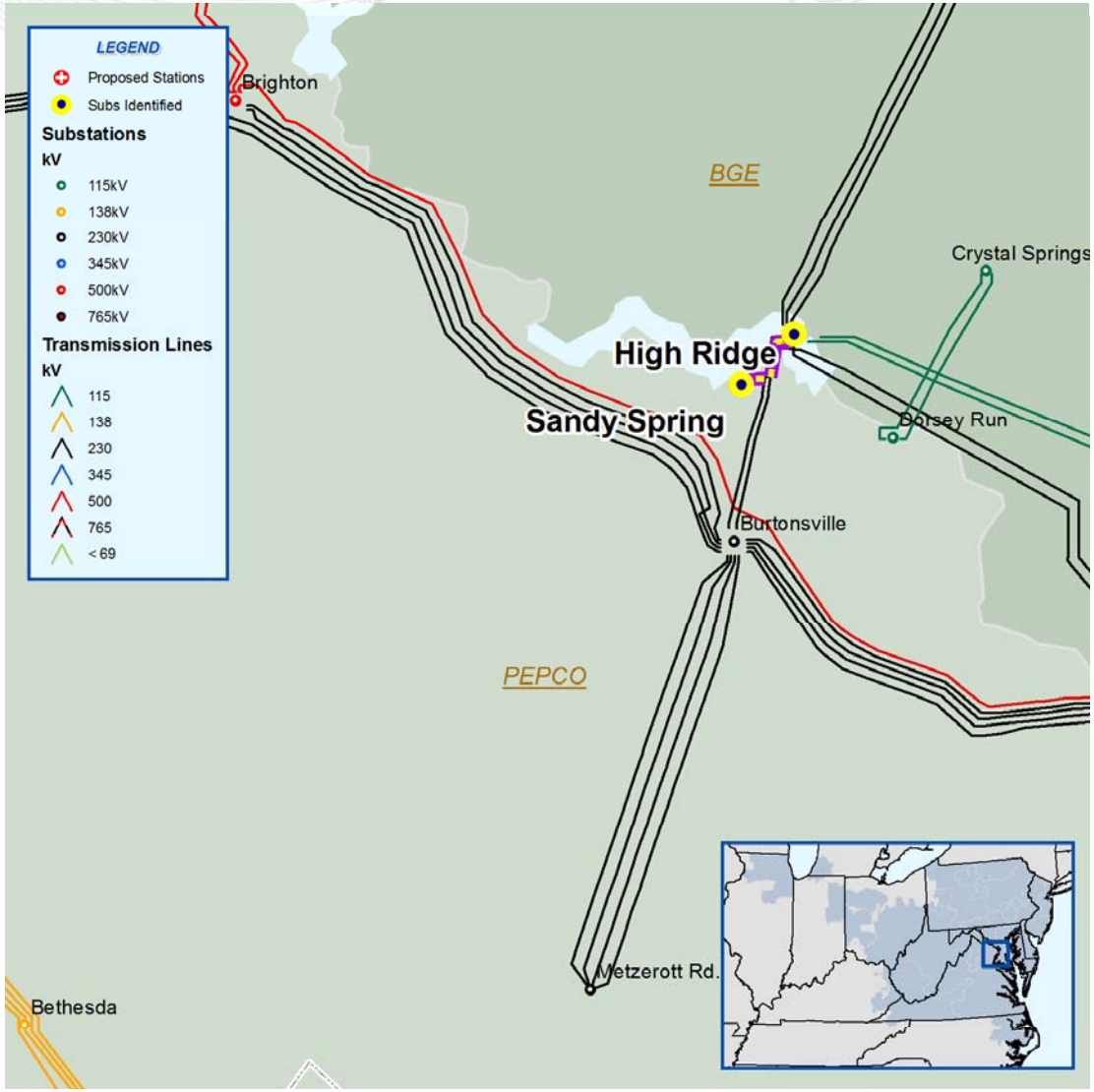
BGE Transmission Zone

- Potential Common Mode Outage violations
- The Graceton – Bagley – Raphael 230 kV circuit is overloaded for the Conastone to North West 230 kV tower line outage
- The Conastone – North West 230 kV circuit (2322) is overloaded for the Brighton – Conastone, Brighton – Doubs 500 kV tower line outage
- The High Ridge – Columbia 230 kV circuit (2312) is overloaded for the Conastone to North West 230 kV tower line outage



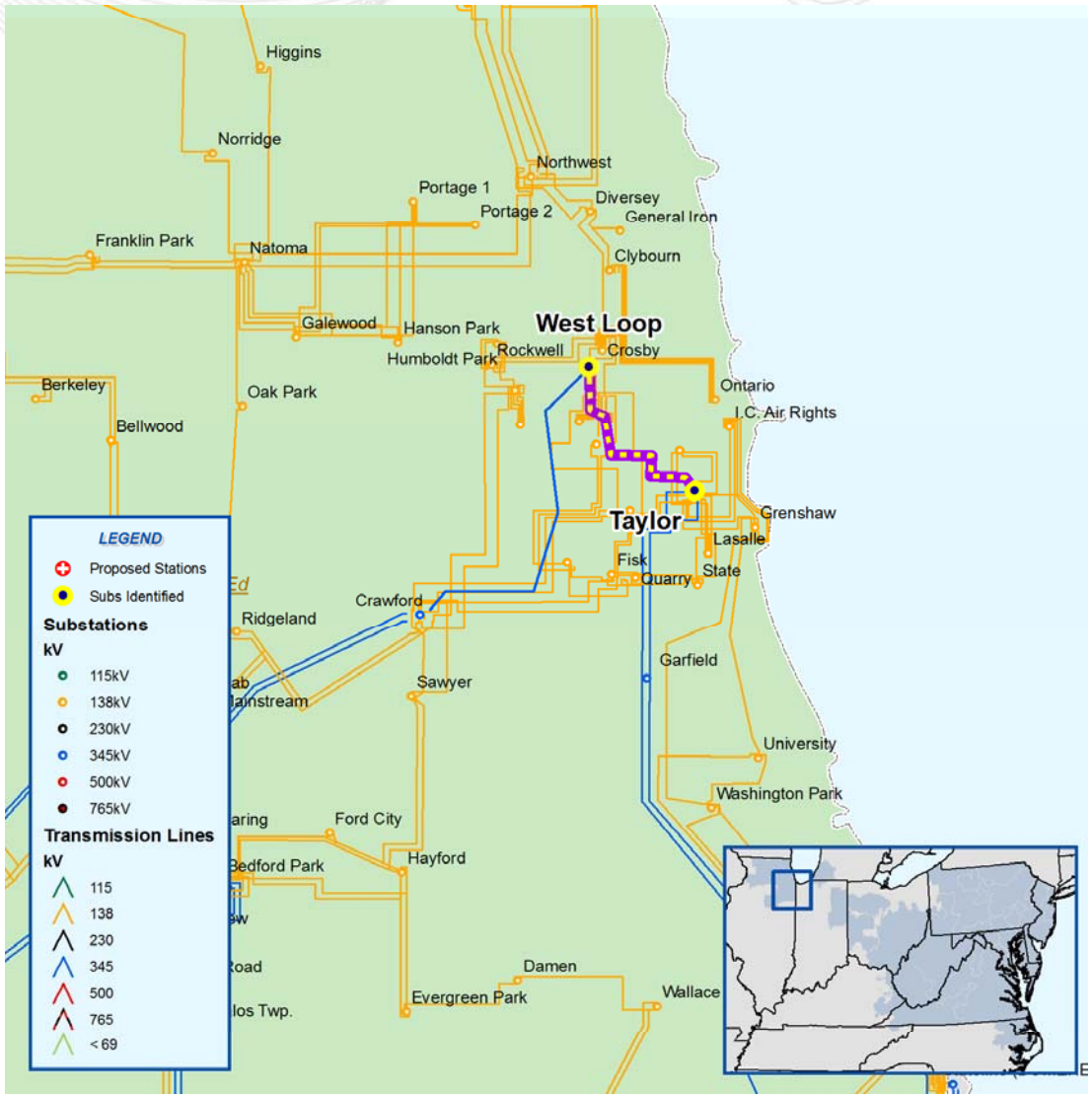
BGE Transmission Zone

- Potential Generation Deliverability violation
- The Sandy Spring – High Ridge 230 kV circuit (2334) is overloaded for loss of the Sandy Spring to Burtonsville 230 kV circuit (2314)
- The Sandy Spring – High Ridge 230 kV circuit (2314) is overloaded for loss of the Sandy Spring to Burtonsville 230 kV circuit (2334)



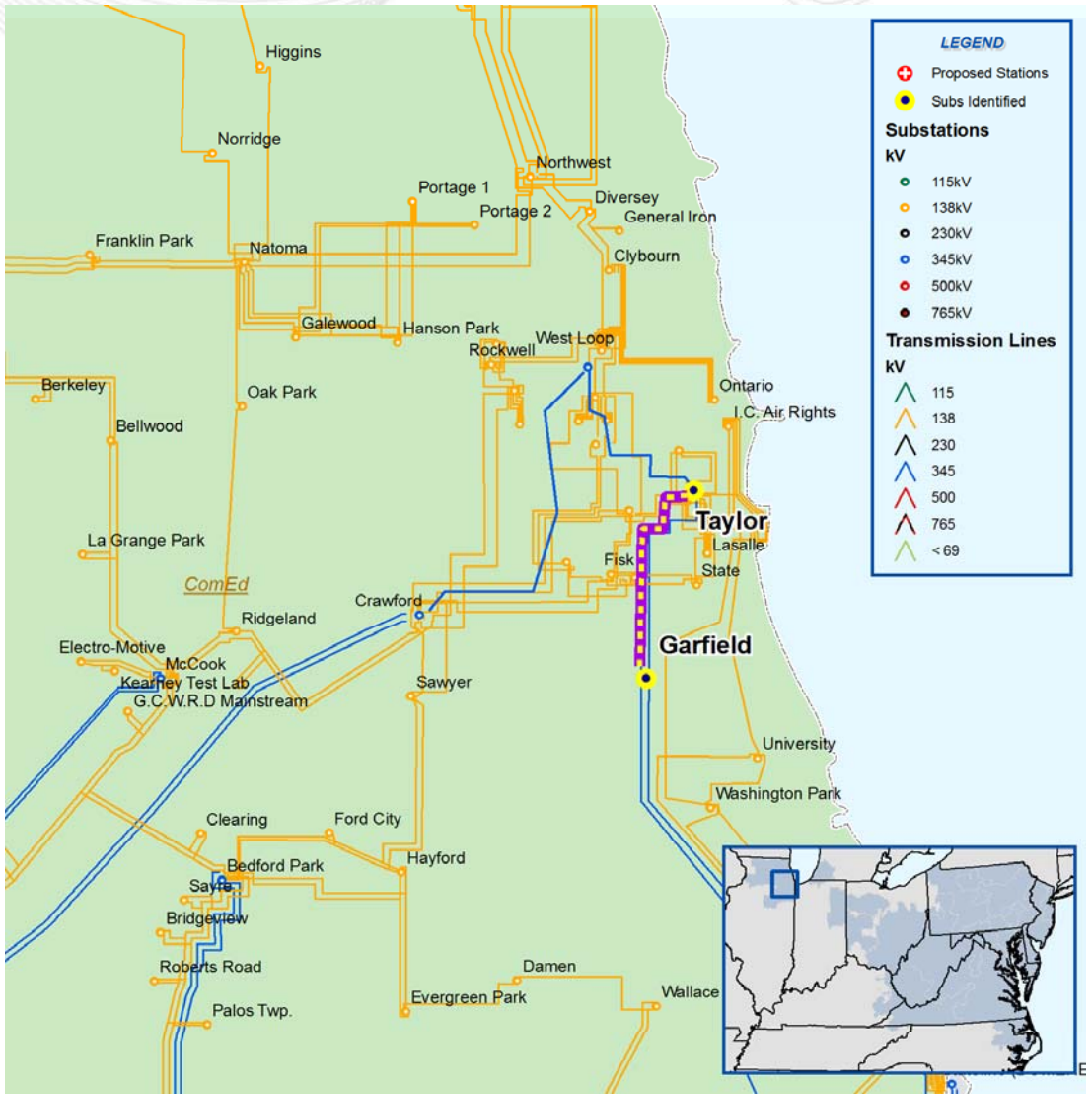
ComEd Transmission Zone

- Potential common mode outage violations
- Taylor – West Loop 345 kV Blue line is overloaded for the common tower contingency with loss of the line #1311 and line #1312
- Lisle Blue 345/138 kV transformer is overloaded for several contingencies



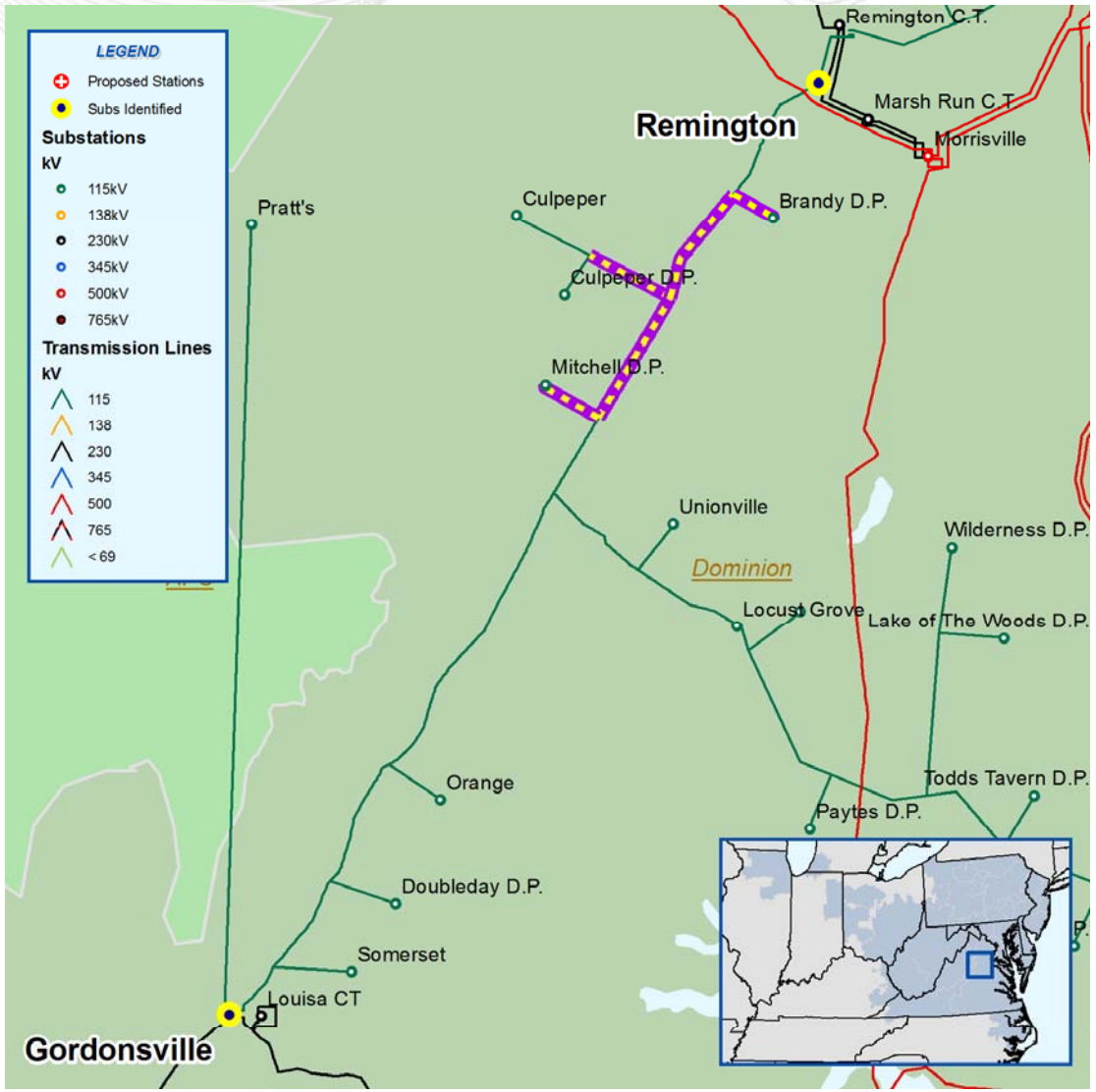
ComEd Transmission Zone

- Potential generator deliverability violation
- Garfield – Taylor 345 kV red is overloaded for the normal system condition
- East Frankfort – Goodings Grove 345 kV red is overloaded for the normal system condition



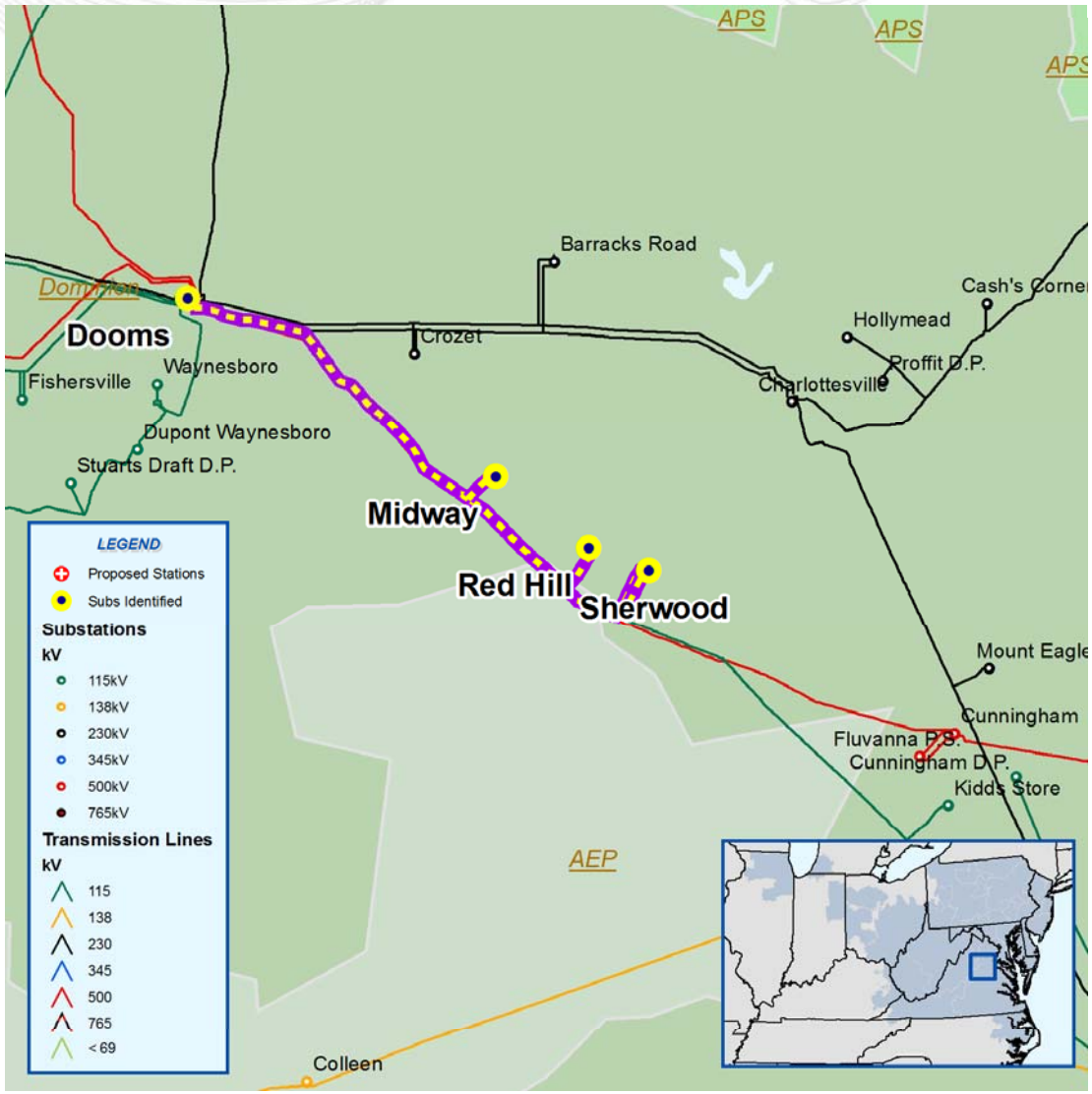
Dominion Transmission Zone

- Potential voltage violation for the common mode outage test
- The Gordonsville 230/115 kV Transformer #1 overloads for the outage of transformer #2
- A line fault with stuck breaker at Remington 230 kV causes low voltage magnitude violations in the Brandy - Culpeper - Mitchell 115 kV area



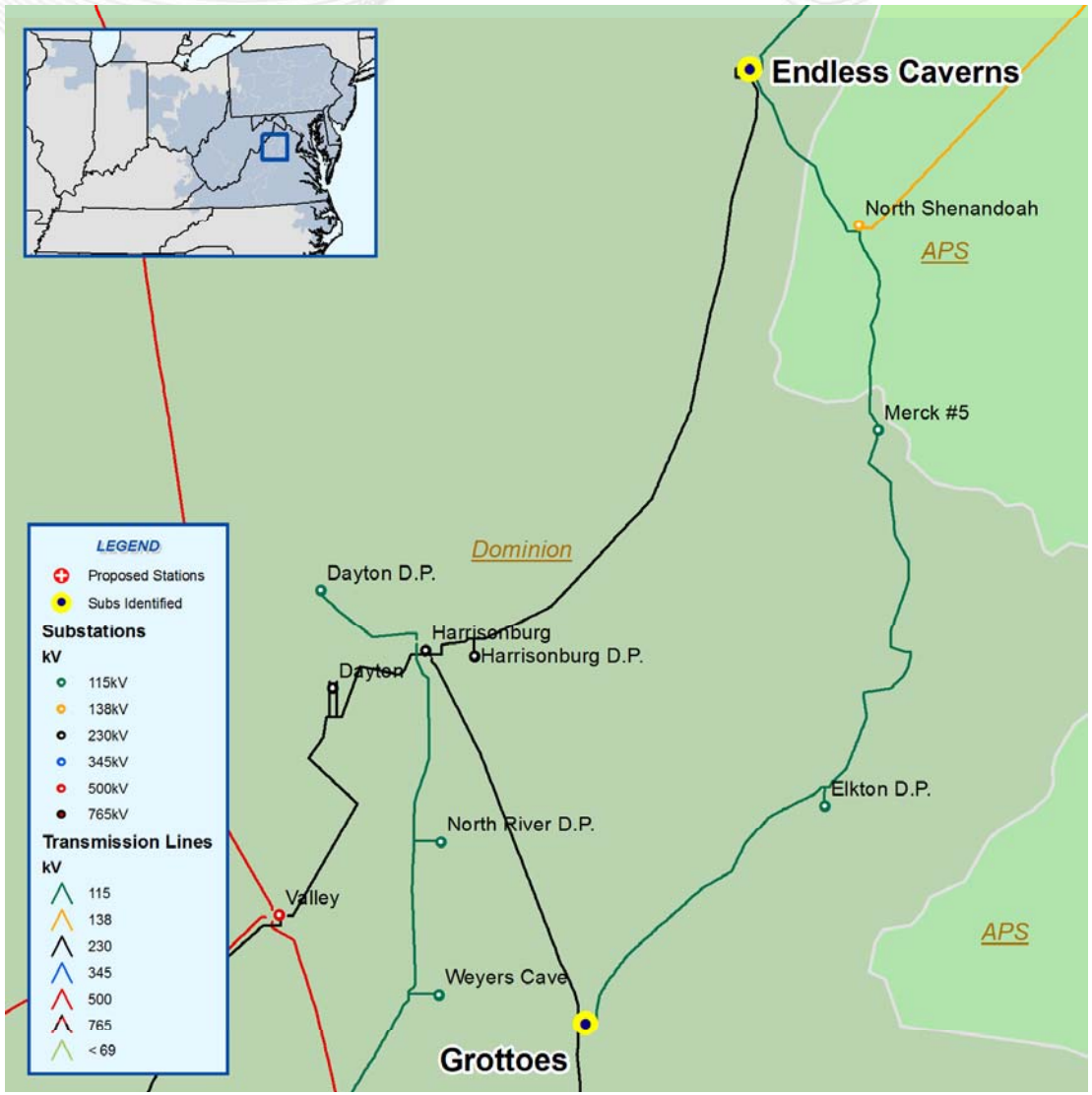
Dominion Transmission Zone

- Potential voltage violation for the common mode outage test
- A bus fault at Dooms 115 kV results in low voltage magnitude violations in the Midway - Red Hill - Sherwood 115 kV area



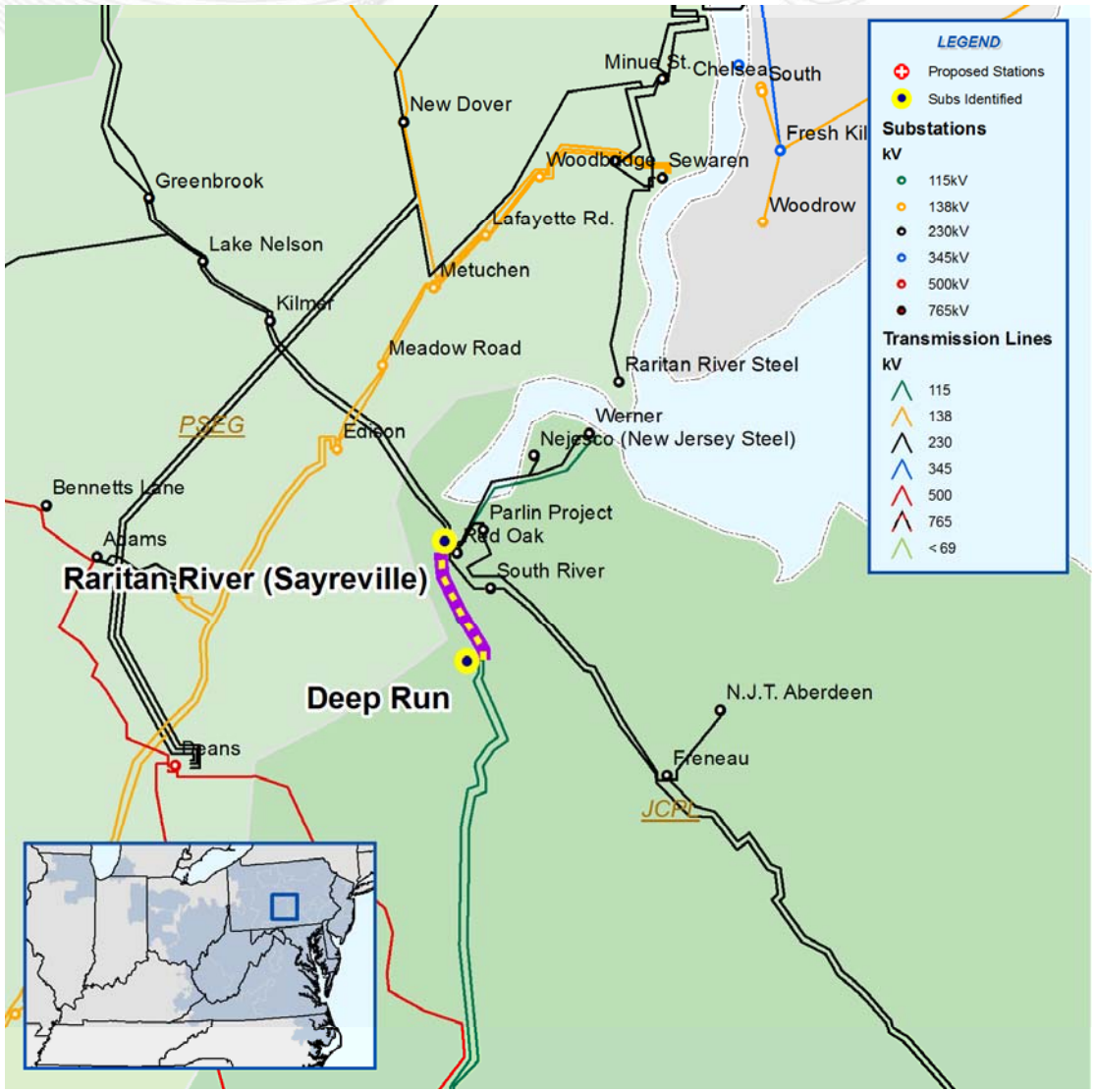
Dominion Transmission Zone

- Potential generator deliverability violation
- The Endless Caverns 230/115 kV transformer overloads for the outage of the Grottoes 230/115 kV transformer



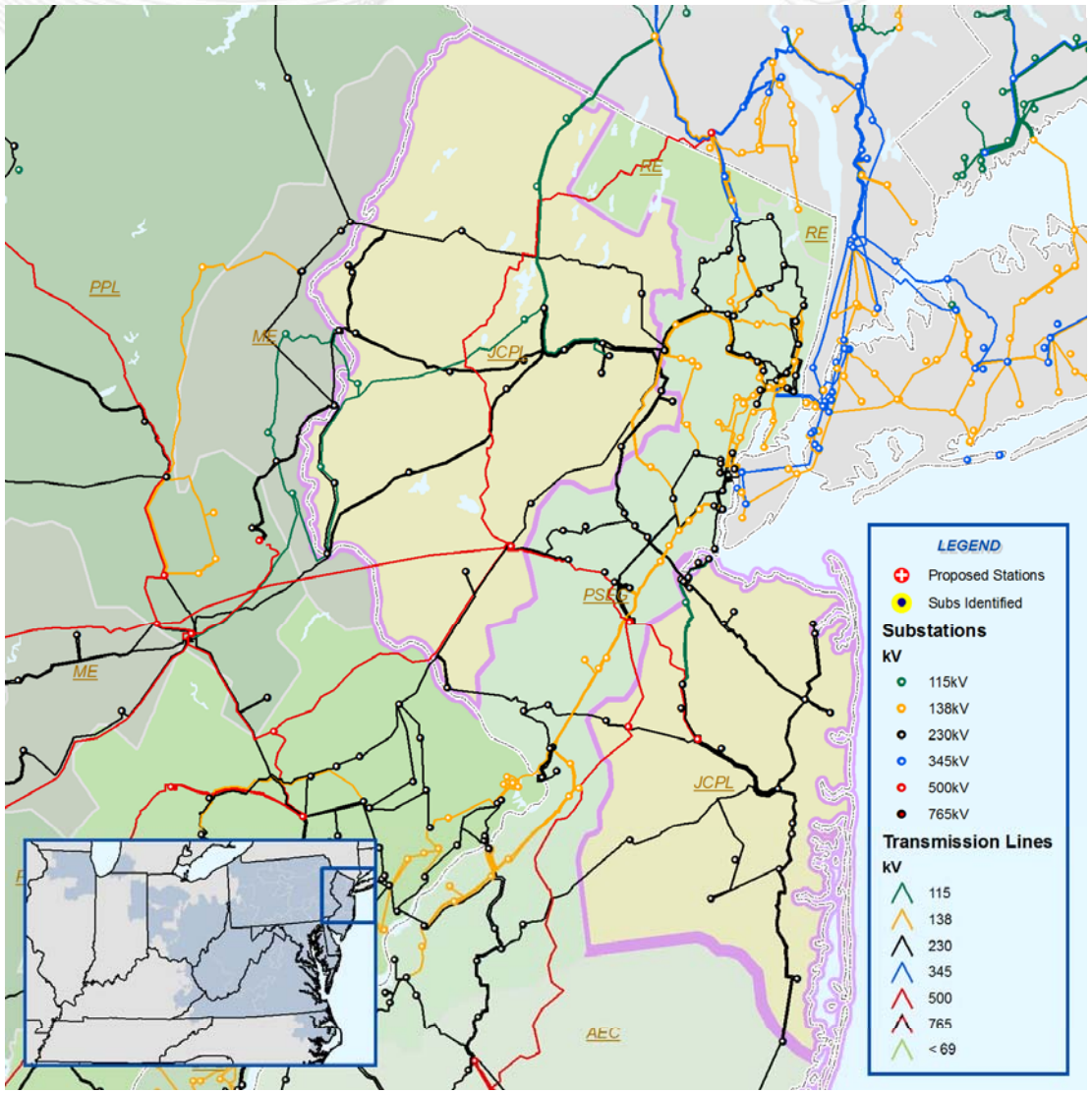
JCPL Transmission Zone

- Potential Common Mode Outage violation
- The Raritian River – Deep Run 115 kV ‘B’ and ‘C’ circuits are overloaded for a line fault stuck breaker contingency that outages the Smithburg – Atlantic and Smithburg – Englishtown 230 kV circuits



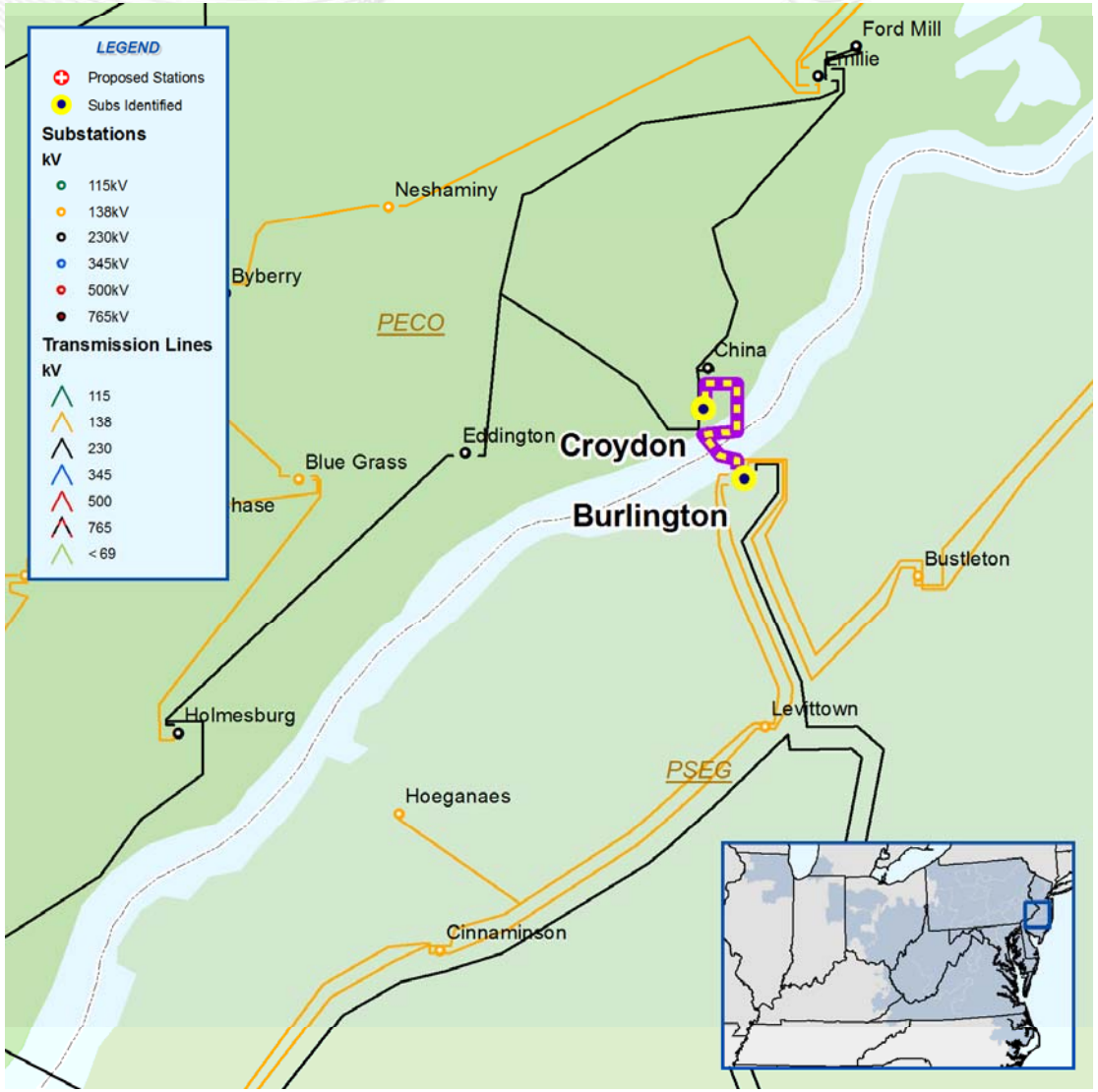
JCPL Transmission Zone

- Potential Load Deliverability violation
- JCPL zonal load deliverability analysis shows voltage collapse violations for several contingencies in JCPL area



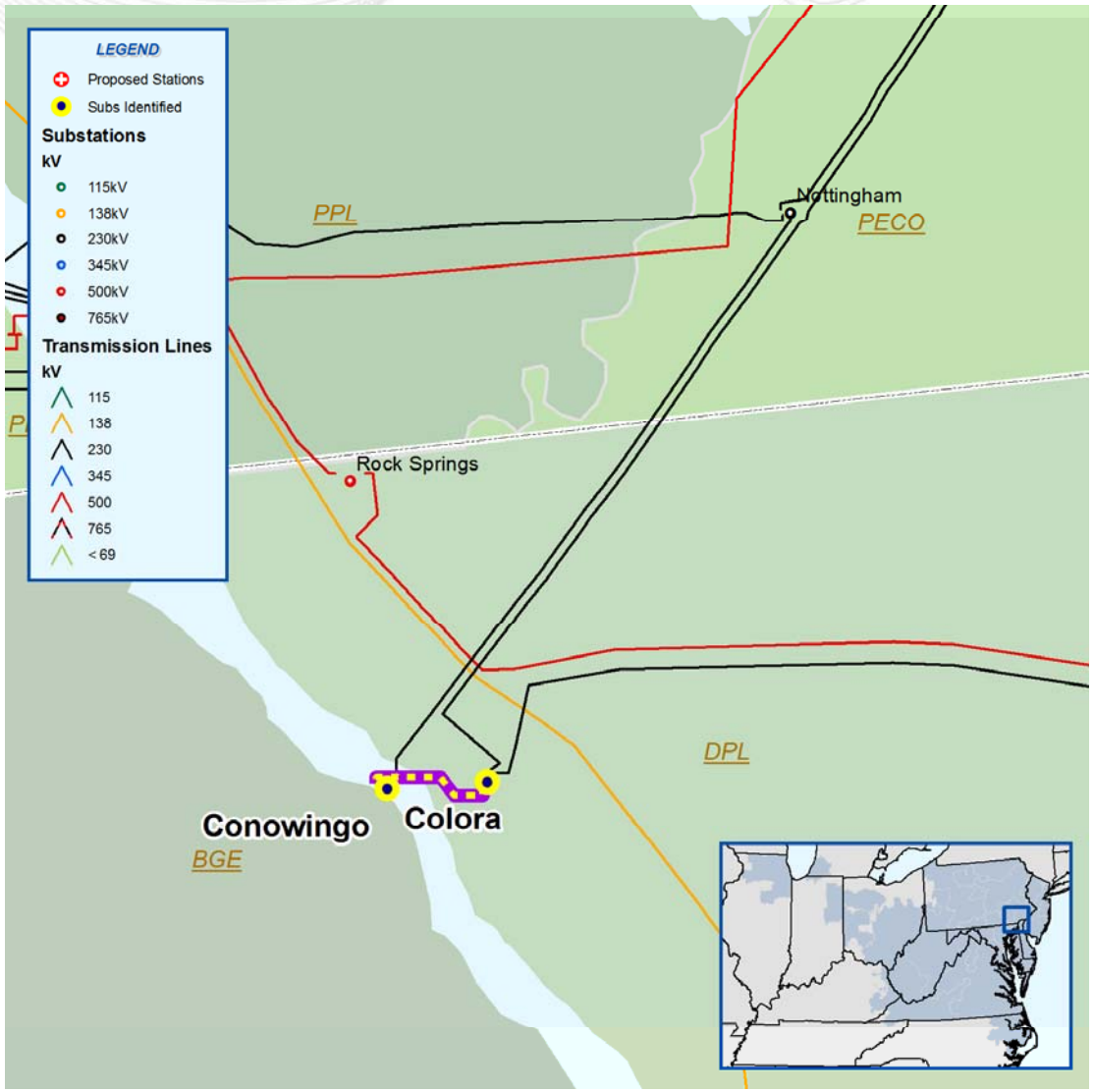
PECO Transmission Zone

- Potential Generation Deliverability violation
- The Croydon – Burlington 230 kV circuit is overloaded for several contingencies



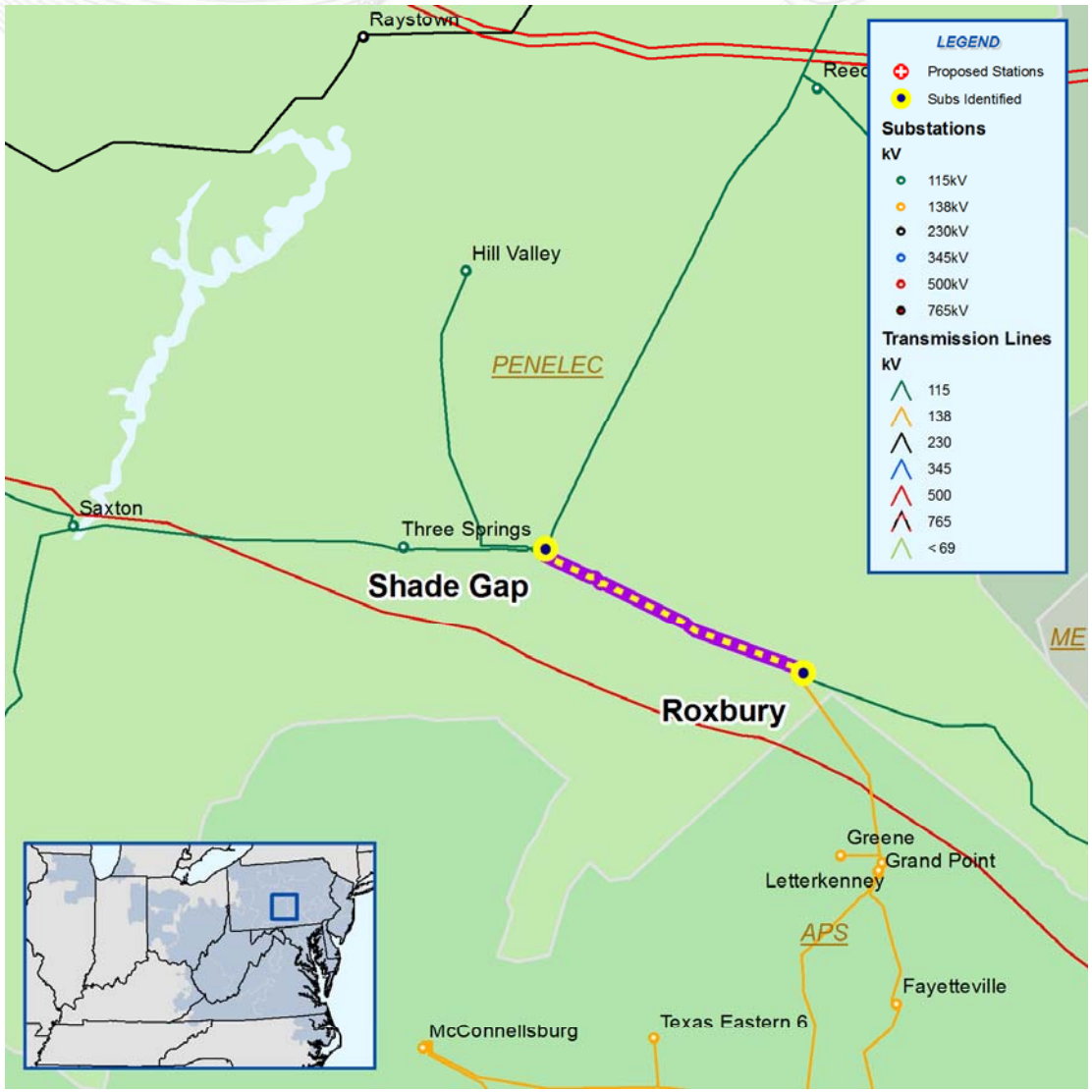
PECO Transmission Zone

- Potential Generation Deliverability violation
- The Conowingo – Colora Tap 230 kV circuit is overloaded for the loss of the Conowingo – Nottingham 230 kV circuit



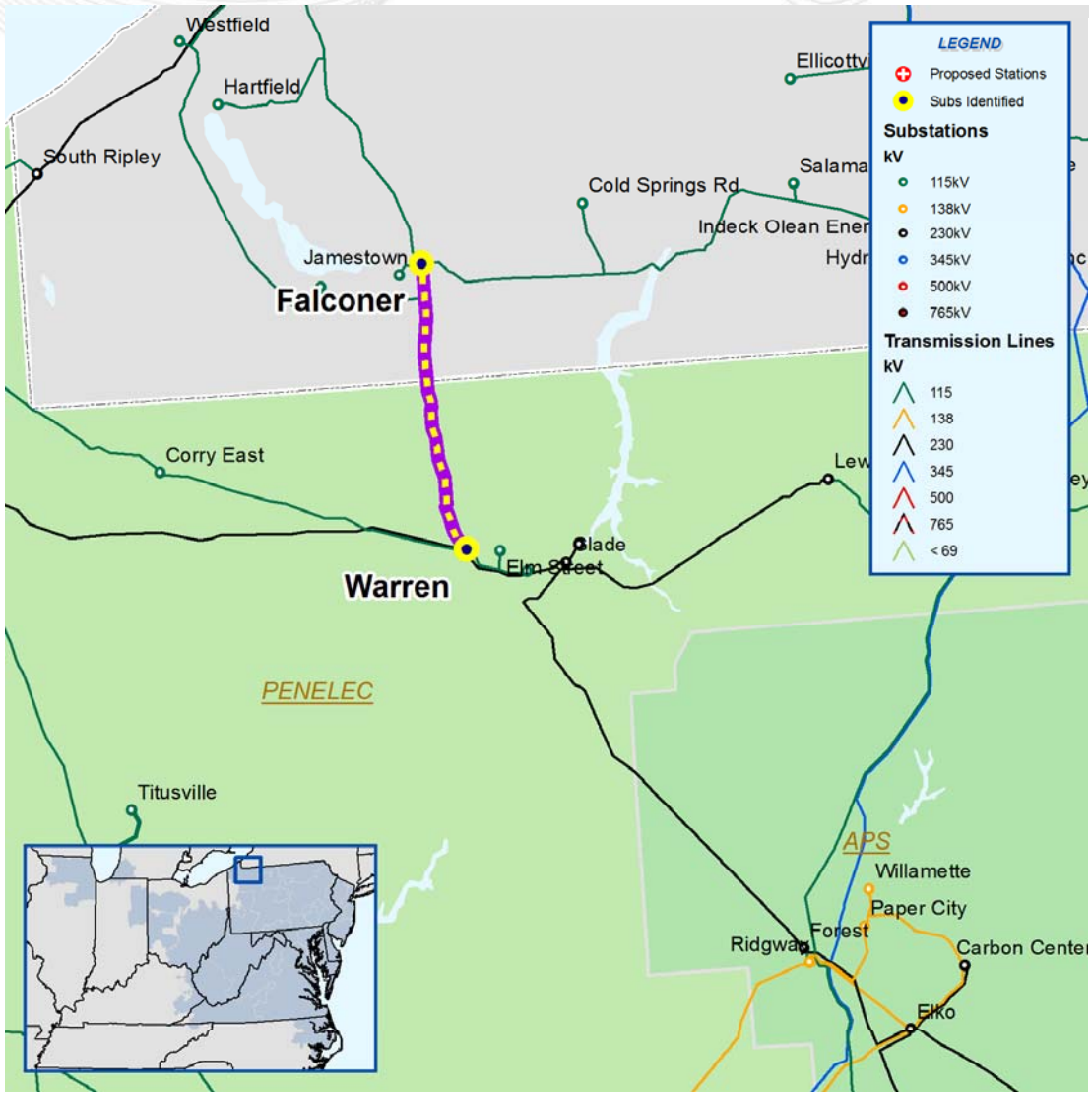
PenElec Transmission Zone

- Potential Generation Deliverability violation
- The Shade Gap – Roxbury 115 kV circuit is overloaded for several contingencies



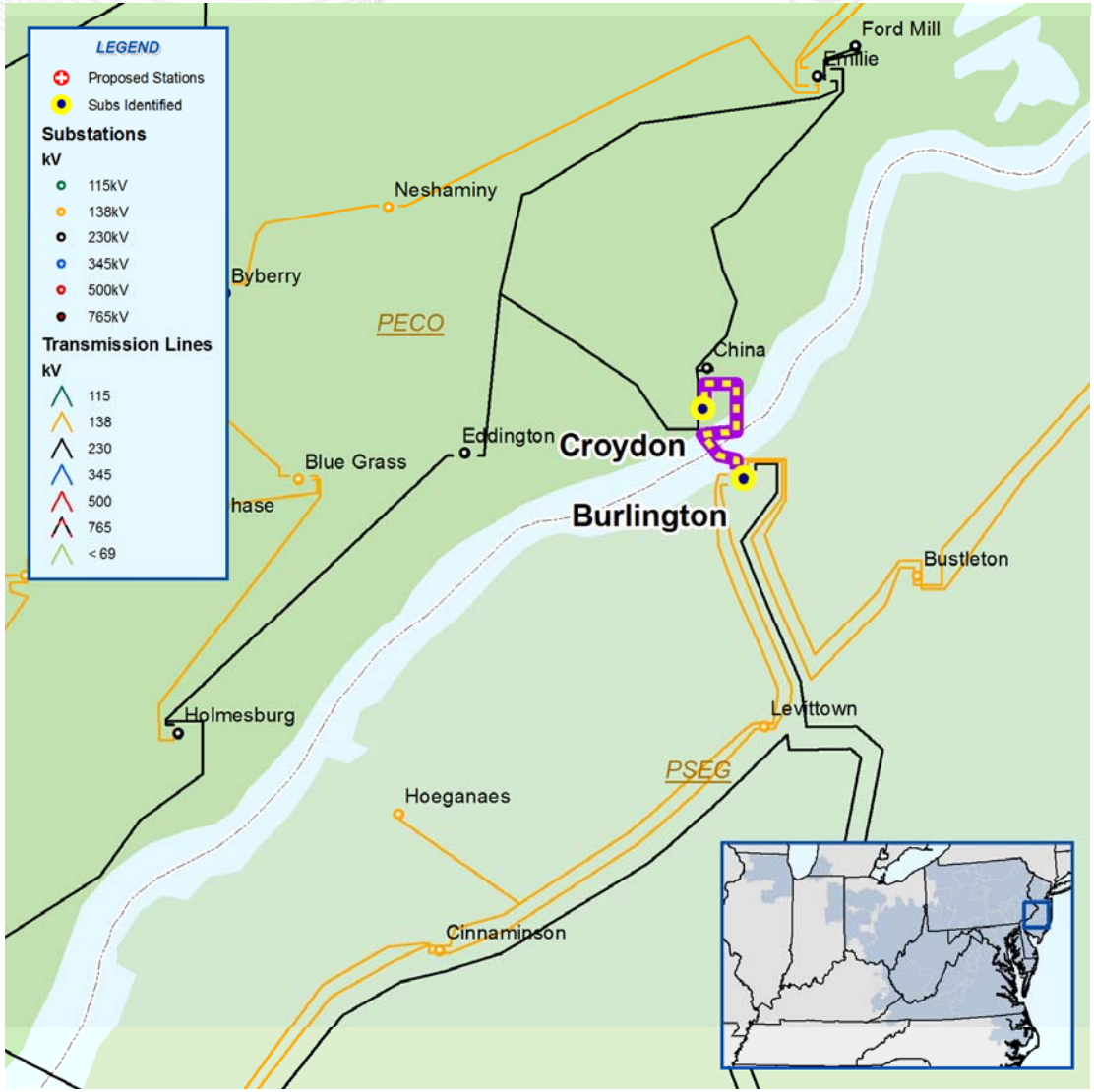
PenElec Transmission Zone

- Potential Common Mode Outage violation
- The Warren – Falconer 115 kV circuit is overloaded for the Glade – Forest, Glade – Lewis Run 230 kV tower line outage



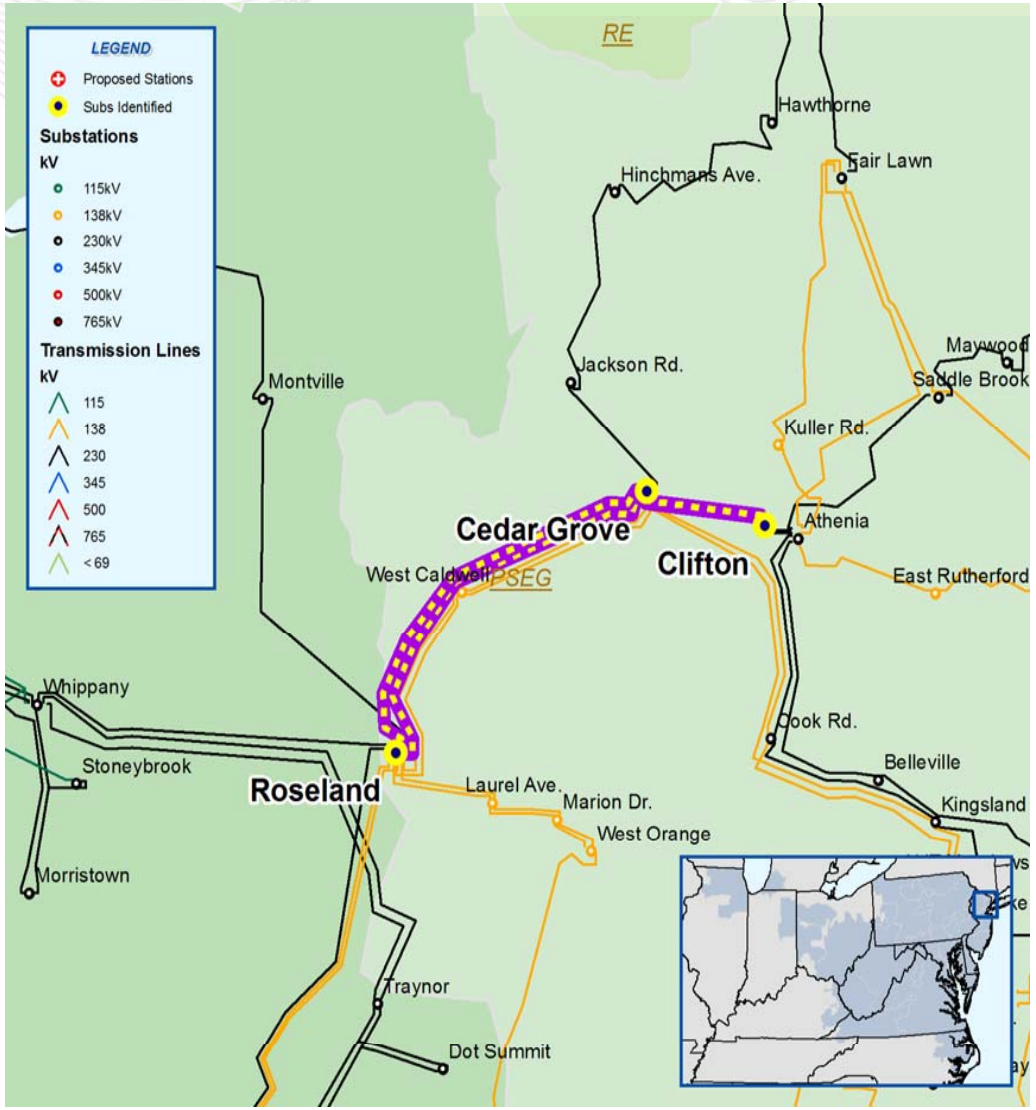
PSEG Transmission Zone

- Potential Generation Deliverability violation
- The Croydon – Burlington 230 kV circuit is overloaded for several contingencies
- The Gloucester – Cuthbert 230 kV circuit is overloaded for several contingencies
- Cuthbert – Camden 230 kV circuit is overloaded for several contingencies
- Eagle Point – Gloucester 230 kV is overloaded for several contingencies



PSEG Transmission Zone

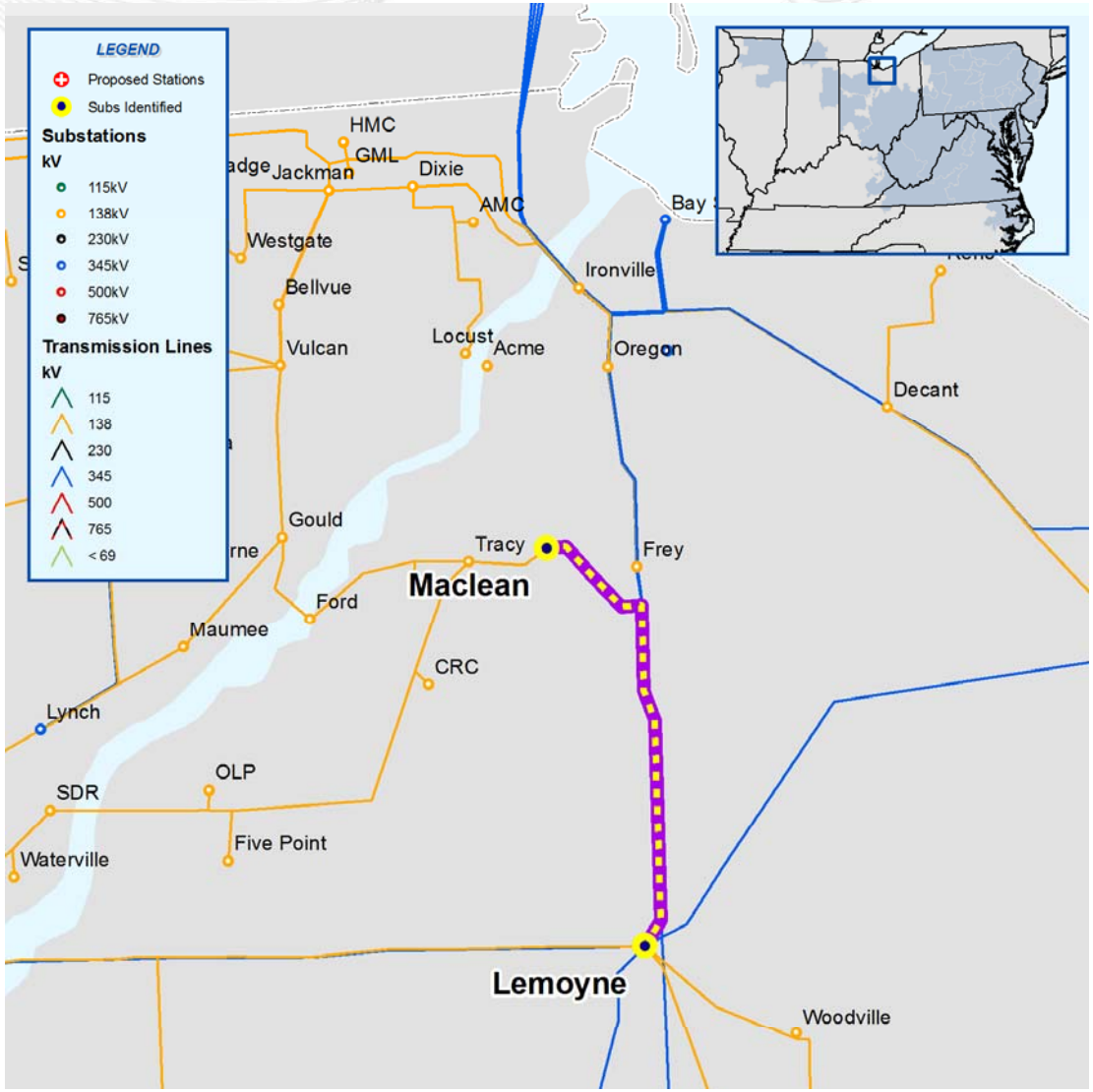
- Potential Load Deliverability violation
- PSEG and PS North Zonal load Deliverability
- The Roseland – Cedar Grove – Clifton 230 kV ‘B’ and circuit is overload for the loss of the Roseland – Cedar Grove – Clifton 230 kV ‘F” circuit
- The Roseland – Cedar Grove – Clifton 230 kV and ‘F’ circuit is overload for the loss of the Roseland – Cedar Grove – Clifton 230 kV ‘B” circuit
- Voltage collapse violations for few 500 kV contingencies for PSEG load deliverability



Baseline Reliability Update

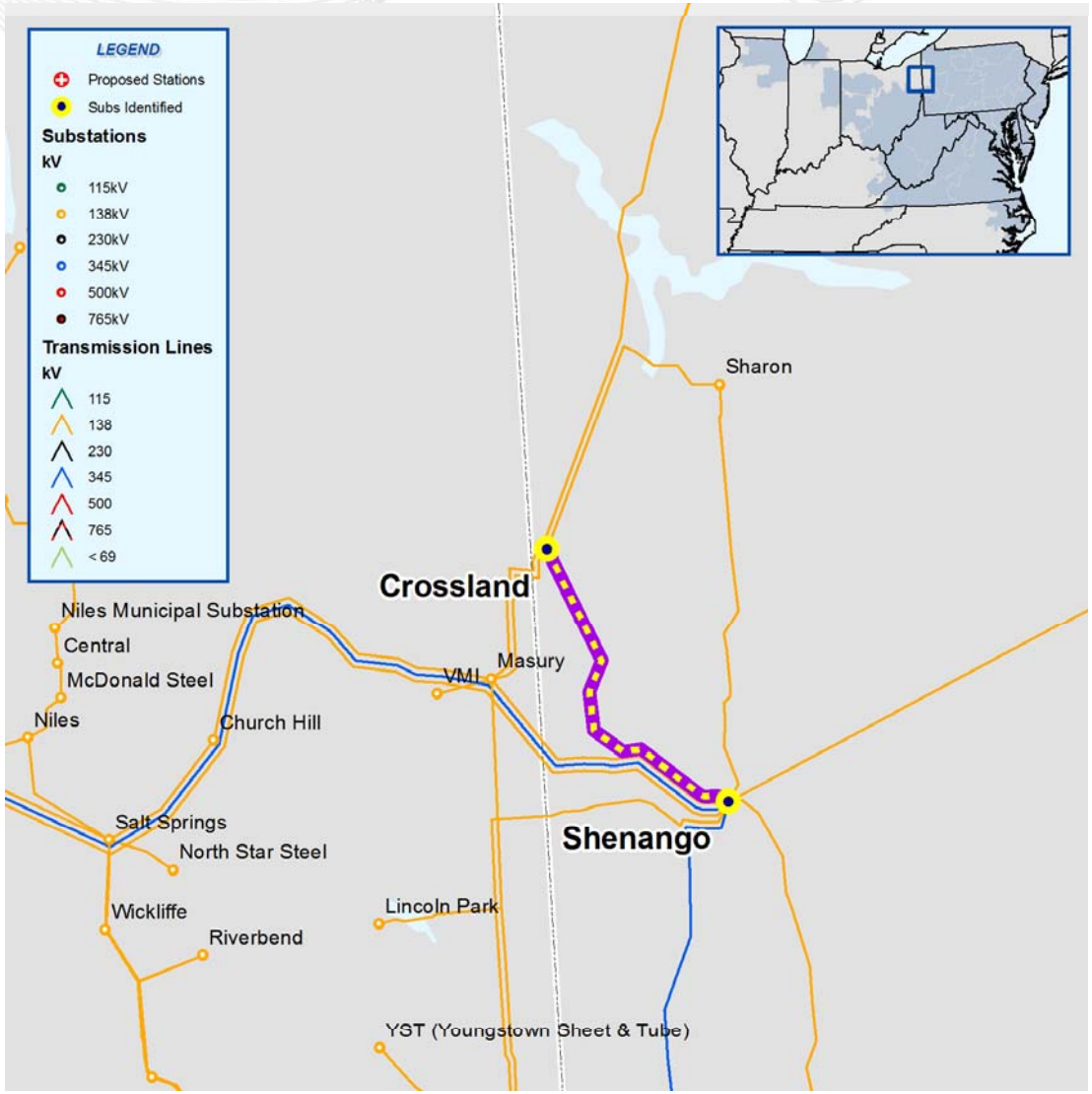
ATSI Transmission Zone

- For the common mode outage test the Lemonyne – Maclean 138 kV circuit is overloaded for breaker failure operation of Bayshore 138 kV BK-JL Breaker
- Recommended Solution: Reconductor Lemoyne – Maclean with 954 ACSS conductor (B1190)
- Estimated Cost: $4.3M
- Expected In-Service Date: 06/01/2013



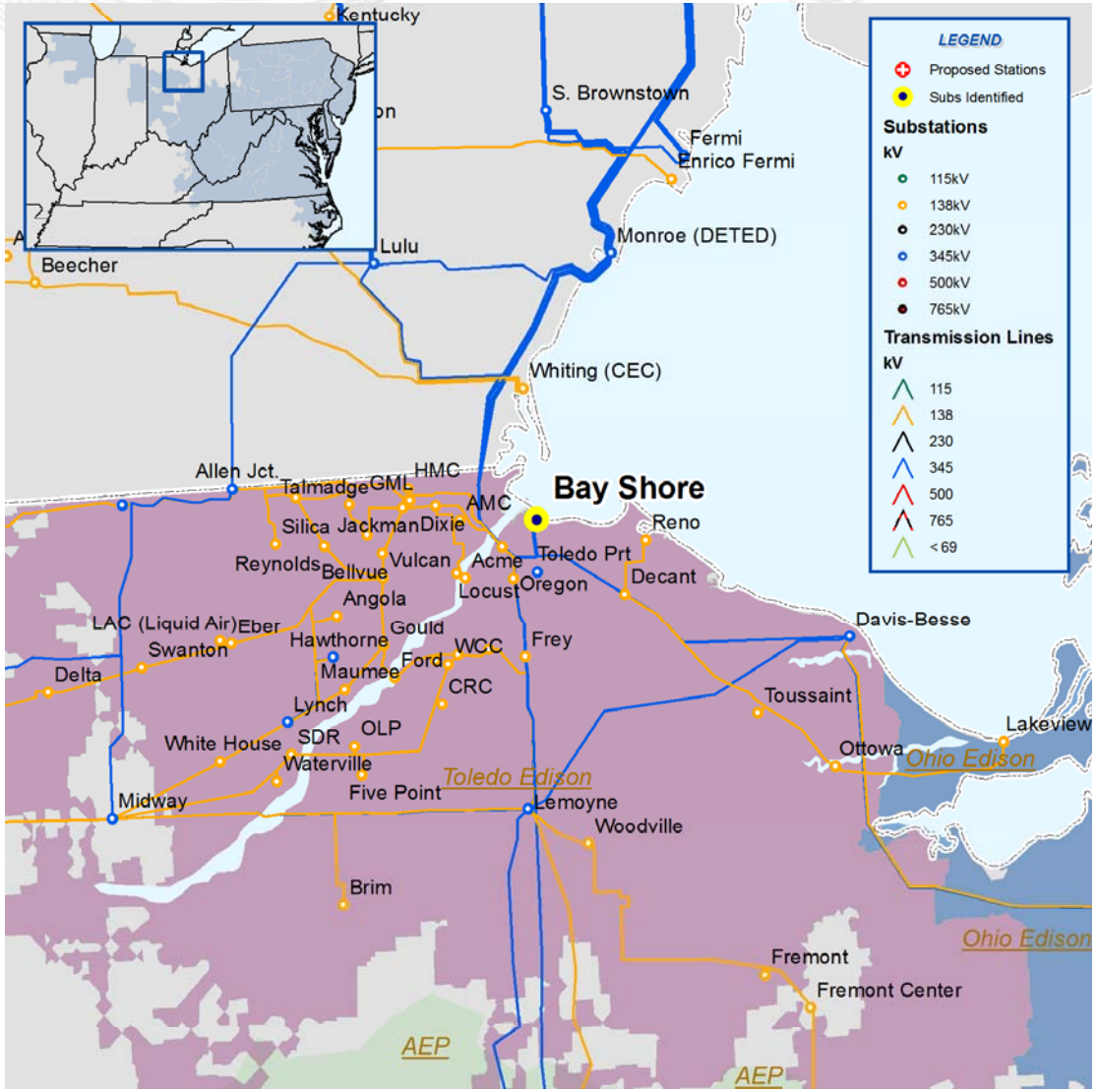
ATSI Transmission Zone

- For the common mode outage test the Shenango – Crossland 138 kV circuit #2 is overloaded for breaker failure operation of Shenango138 kV BK-18 Breaker
- Recommended Solution: Replace the meter at Crossland with a higher rated meter (B1191)
- Estimated Cost: $0.015M
- Expected In-Service Date: 06/01/2013



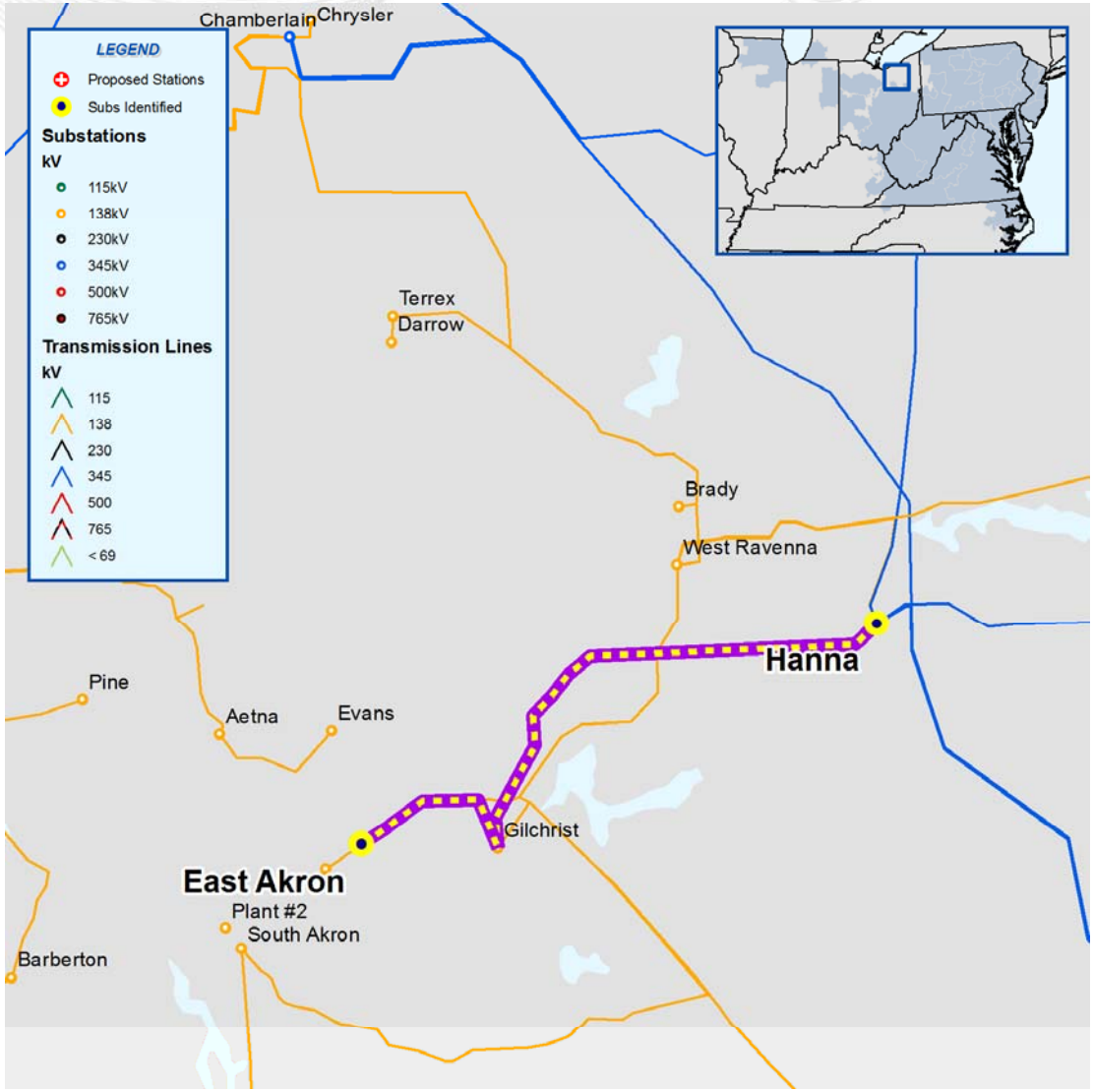
ATSI Transmission Zone

- For the common mode outage test the Bayshore – Chevy 138 kV circuit is overloaded for breaker failure operation of the Bayshore 138 kV BK-3K, BK-13254,BK-13256,BUS-K, BK-13252 or BK-KM breakers
- Recommended Solution: Reconductor Bayshore – Chevy 138 kV with 636 ACSS conductor (B1192)
- Estimated Cost: $4.3M
- Expected In-Service Date: 06/01/2013



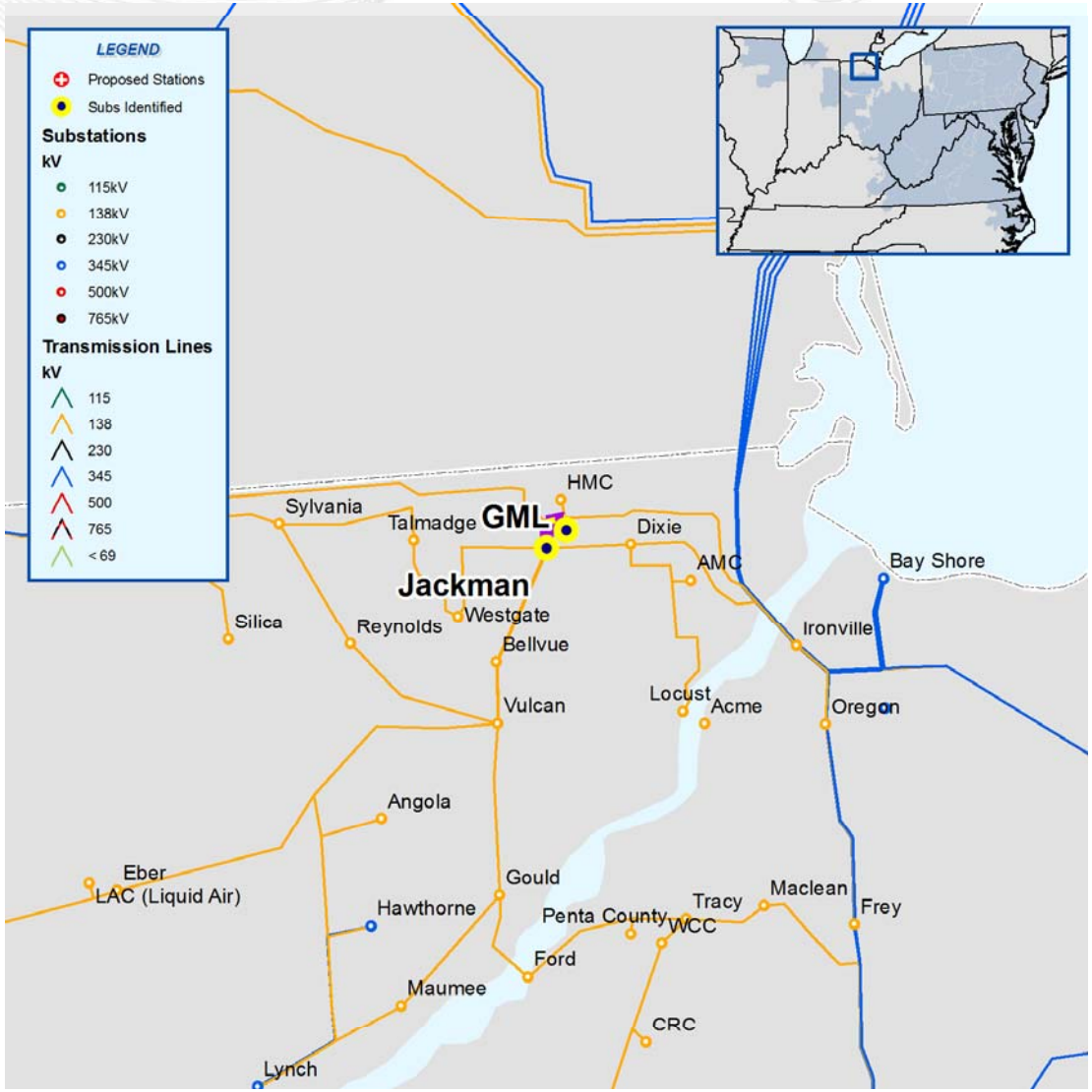
ATSI Transmission Zone

- For the common mode outage test the Hanna – East Akron 138 kV circuit is overloaded for breaker failure operation of West Ravenna 138 kV BK-15K and the tower outage of the Hanna – West Ravenna #1 and the Hanna – West Ravenna #2 138 kV lines
- Reccomended Solution: Replace the 800 Amp wavetrap at East Akron with a 1200 Amp wavetrap (B1193)
- Estimated Cost: $0.052M
- Expected In-Service Date: 06/01/2013



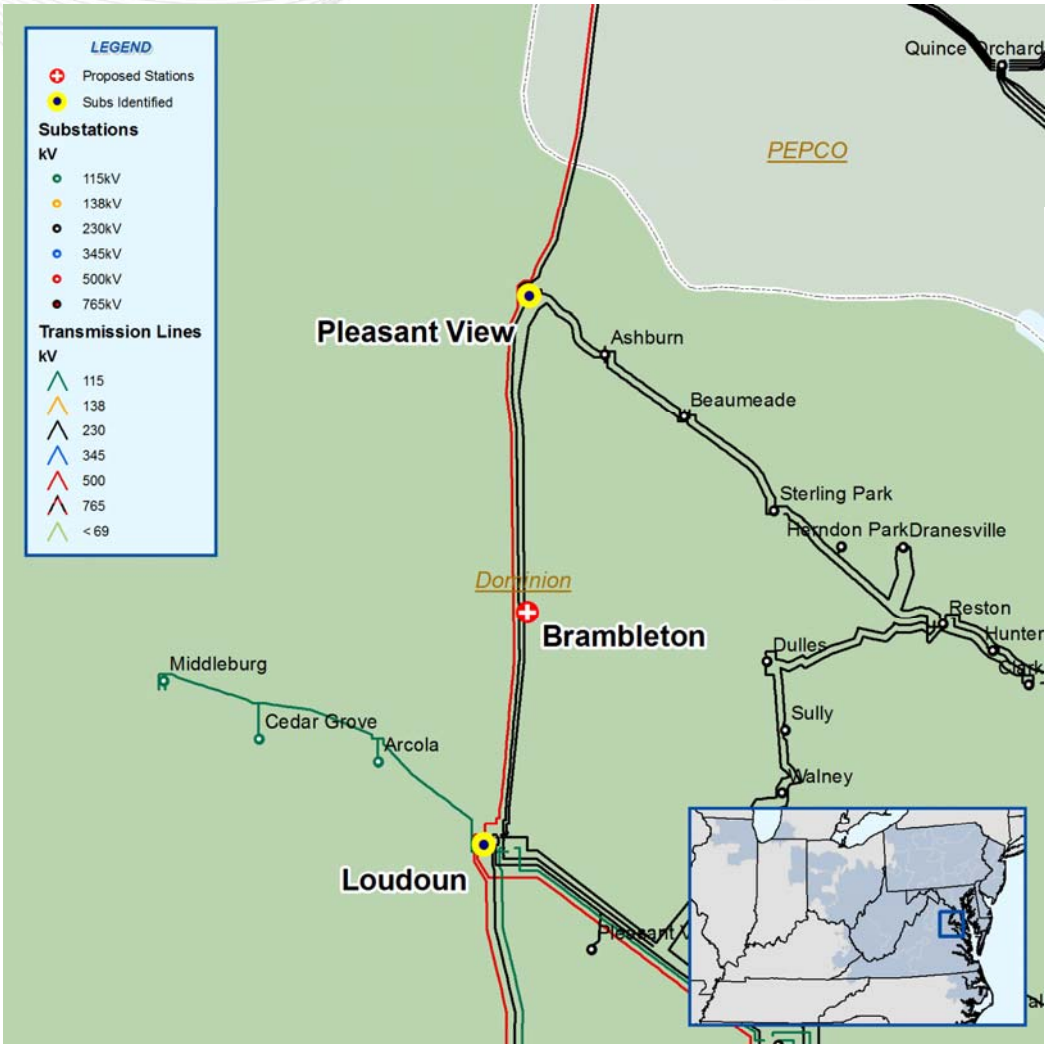
ATSI Transmission Zone

- For the common mode outage test the General Mills – Jackman 138 kV circuit is overloaded for the breaker failure operation of the Bayshore138 kV BK-13254, BK-13256, BK-13252, BUS-K, or BK-KM breakers
- Recommended Solution: Reconductor General Mills – Jackman 138 kV with 636 ACSS conductor (B1194)
- Estimated Cost: $0.647M
- Expected In-Service Date: 06/01/2013



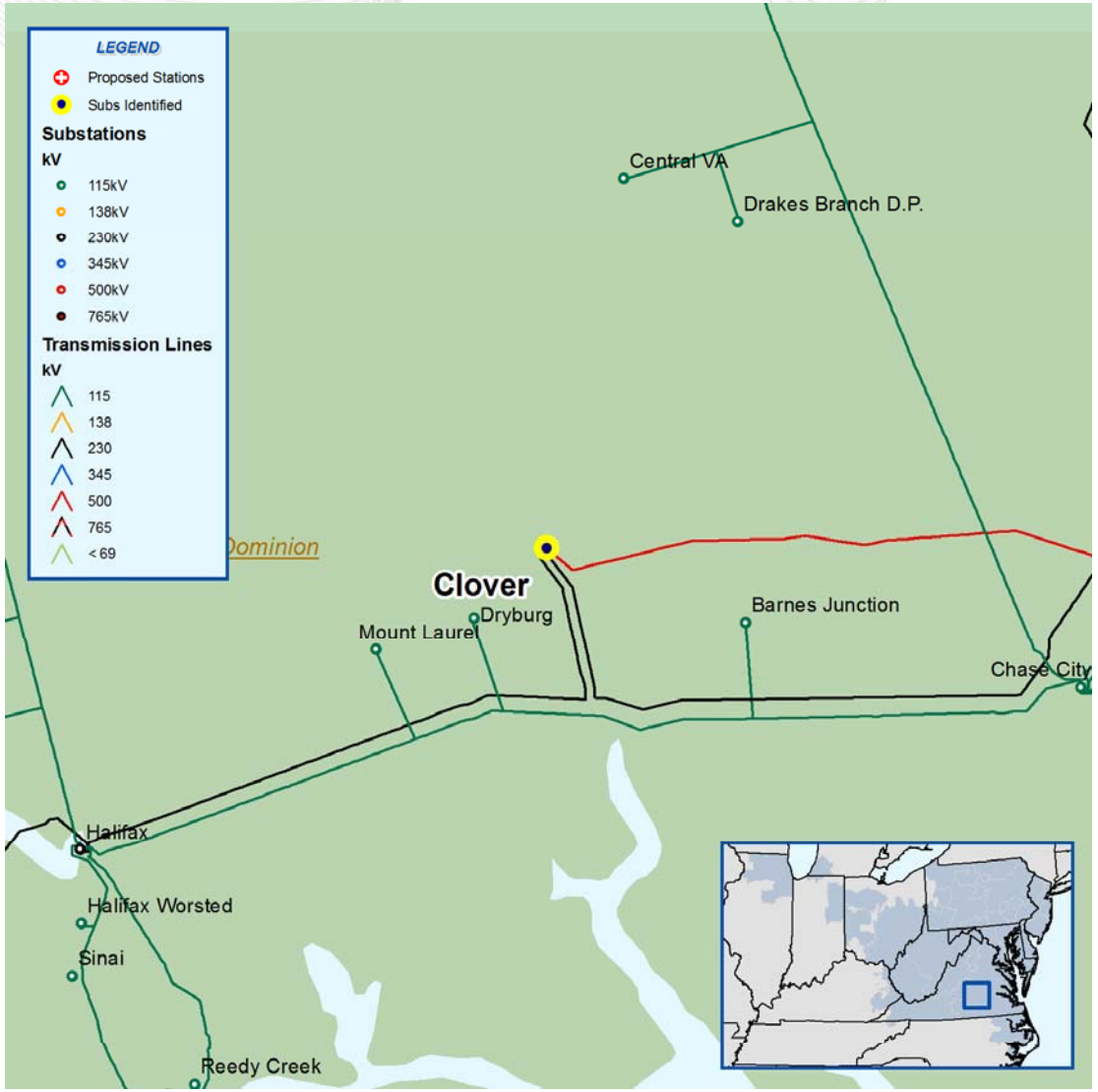
DominionTransmission Zone

- For Dominion and PEPCO Load Deliverability the Pleasant View 500/230 kV transformer is overloaded for the outage of Doubs to Brighton 500 kV and one Loudoun 500/230 kV transformer overloads for the outage of the parallel transformer
- Recommended Solution: Install Brambleton 500/230 kV transformer and associated breakers
- Estimated cost: $18 M
- Expected In-service: 06/01/2014



DominionTransmission Zone

- For Dominion Load Deliverability the Clover 500/230 kV transformer is overloaded for the outage of the Carson to Wake 500 kV line along with low voltages in the Clover area
- Recommended Solution: Install 2nd Clover 500/230 kV transformer and a 150 MVAr capacitor
- Estimated cost: $16 M
- Expected In-service: 06/01/2015



Review Issues Tracking

- Alternative Analysis
  - Combinations of alternatives, transmission, and reactive upgrades

- Interim TEAC meeting to discuss progress
  - Week of Wednesday, May 26th ?